

## Thoughts on The Connections Between Ecological And Human Health

As people engaged in ecological restoration, conservation planning and regenerative design, we think a lot about connections. We know we wouldn't be able to enjoy a cup of coffee were it not for pollinators. We know how the journey of a raindrop landing on a city rooftop is linked to elevated nitrogen levels in a nearby estuary. We even draw solid connections between restored ecosystems and economic growth. But how much time do we spend thinking about the connections between our work and public health?



How much do we know about the connections between the ecosystem health and the health and well-being of people? How can we better understand this connection and integrate it more deeply into our work?

To begin to examine this topic, we talk with three visionaries whose work directly relates to the intersection of ecology and human health.



First, we talk with award-winning ecologist and author [Sandra Steingraber](#). Diagnosed with what she calls the "quintessential environmental cancer" at age 20, Sandra is all too familiar with the connection we explore in this issue of *Leaf Litter*. She takes a personal and scientific look at the links between health, human rights, and the environment, with a focus on chemical

contamination.

We also chat with ecological economist [Bob Costanza](#), well known for his groundbreaking attempt to quantify the economic value of the natural world in 1997. Now the Director of the Institute for Sustainable Solutions at Portland State University and the founding editor in chief of the journal [Solutions](#), Bob talks about the true economics of well-being, and the role played by ecological function.



We also interview [Randy Hester](#), a landscape architect and sociologist who has blended these disciplines for more than 30 years toward the creation of what he calls "ecological democracy."



Ecological landscape designer Nicole Stern explores the relationship between water [quality and public health](#).

Landscape Architect Jennifer Dowdell and colleagues present a [brief introduction to environmental justice](#), a topic that cannot be ignored when discussing the links between ecological and human health.

We share some [links and helpful resources](#) and tell you about [some Biohabitats projects](#) that integrate human health. We'll also update you on [the latest Biohappenings](#).



What are your thoughts? Share them on our blog, [Rhizome](#), or make a comment on the [Biohabitats Facebook page](#). If you want to reference a specific article, be sure to include it in your post. In the meantime, we hope you enjoy this issue of *Leaf Litter*. Here's to your health!

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## Leaf Litter Talks With Sandra Steingraber

After being diagnosed with bladder cancer as a sophomore in college, Dr. Sandra Steingraber discovered an apparent cancer cluster in her hometown in Illinois. Armed with the belief that it was caused by industries lining the region's river valley and the widespread use of pesticides on farms in the area, Dr. Steingraber dedicated her career to shedding light on the links between cancer and environmental contamination.



She is the author of [Living Downstream: An Ecologist's Personal Investigation of Cancer and the Environment](#), [Having Faith: An Ecologist's Journey to Motherhood](#), and her most recent book, [Raising Elijah: Protecting Our Children in an Age of Environmental Crisis](#). Released in a second edition in 2010, [Living Downstream](#) is now the subject of [an award-winning documentary film](#) produced by the People's Picture Company of Toronto.

Dr. Steingraber is a scholar in residence at Ithaca College, a columnist and contributing editor at [Orion](#) magazine, and a lecturer. She has testified in

front of the European Parliament and before the U.S. President's Cancer Panel, and served on the U.S. Department of Health and Human Services' National Action Plan on Breast Cancer.

Over the course of her career as an ecologist and author, Dr. Steingraber has received numerous honors and awards. Just last week, she was awarded the prestigious [Heinz Award](#) for her work linking toxic chemical exposure to disease. How does she plan to spend this \$100,000 prize? In the battle against hydrofracking in upstate New York, where she lives with her husband and two children. To those who might question this decision, she says, "Some might look at my small house (with its mismatched furniture) or my small bank accounts (with their absence of a college fund or a retirement plan) and question my priorities. But the bodies of my children are the rearranged molecules of the air, water, and food streaming through them. As their mother, there is no more important investment that I could make right now than to support the fight for the integrity of the ecological system that makes their lives possible."

**How has your background as an ecologist affected your ability to research your own cancer and environmental health in general?**

My background as an ecologist was actually prompted by my experience with cancer. I was diagnosed at age 20 with bladder cancer. At the time, I was an undergraduate biology major with plans for medical school. Waking up in the hospital and experiencing cancer at that young age, I realized that I didn't want a hospital to be my workplace. I wanted to have as little to do with the IV drips, grey partition curtains, and medical data as possible.



I was prompted by my diagnosing physician to look into the environmental contributions to my cancer. He asked if I had ever vulcanized tires, smelted aluminum, or had anything to do with textile dyes. While the answers to all of those questions was no, I was aware that there was an aluminum smelter in my hometown, that I lived

downwind from two coal burning power plants, and that there was a lot of pesticide intensive agriculture in my community. So the question about how environmental health and human health are related to each other came immediately and very urgently to my attention as a young biologist. Once I realized that bladder cancer is a quintessential environmental cancer, and that my aunt died of the same kind of bladder cancer I had even though I'm adopted, I became very interested in understanding cancer clusters and what else families had in common: air, food and water.

At the same time, I also felt like I wanted to get away from toxic stuff in laboratories, so I became a field biologist. My graduate research took on a straightforward question in the field of community ecology. I did my dissertation near the headwaters of the Mississippi River in northern Minnesota, in what I thought was a very pristine habitat. The idea of doing science outside, away from labs and chemicals, was very attractive to me. I came to find out, however, that my study site-a beautiful red pine forest-had actually been sprayed with Agent Orange a decade earlier. That fact was hidden and I actually uncovered it in some secret memoranda

fact was hidden, and I actually discovered it in some secret memoranda that had gone back and forth between the Minnesota Department of Natural Resources and the state park managers. With that, I realized that I had likely been exposed to dioxin, as had Vietnam veterans who dealt with Agent Orange. Even though it wasn't being sprayed while I was there, dioxin can last up to fifty years in human tissue and in soil. I realized then that there really was no "away." As a cancer patient and now an environmental scientist, I knew I couldn't keep searching for pristine places and escape toxic chemicals.

I realized that I needed to take my experience as a cancer patient and what I know as a PhD biologist and make this my career. It was those two experiences-my own cancer diagnosis and the discovery of Agent Orange in my field site-that led me down this path.

**Based on your knowledge as an ecologist and as someone who has researched and written about environmental health, which human influence on the landscape has been (or is likely to be) the most damaging to both ecological and human health?**

I would say it is fracking. If you had asked me that question five years ago, before fracking really sank its teeth into our bedrock, I wouldn't have had an answer. I would have said it depends on where you live. It might be pesticides if you live in a very agriculturally intensive region like California's central valley. If you live in Patterson, New Jersey, it might be toxic waste sites, and so forth. But now, I would unequivocally say fracking.

By "fracking," I am referring to the hydraulic fracturing technique for extracting natural gas from shale. It is a technology that is dependent on inherently toxic chemicals, it is happening all over the nation and therefore exposing huge numbers of people to those chemicals, and those exposures are happening through what we call multiple environmental media. By that I mean that fracking contributes to air pollution and water contamination, and it threatens to contaminate the food supply. It is possible to be exposed through at least three different routes, and those contaminants include not just chemical contaminants but radioactivity as well. Because natural gas is a fossil fuel, it contributes to global warming, which itself is probably the biggest human health threat to the world's children. Not future generations, but children living now.



*Image courtesy of David Walczak, member of [Coalition to Protect New York](#)*

**At this point, what do we know about the long-term impacts of fracking to the environment and to human health?**

Some things we know, some things we expect, and some things we simply worry about. The dangers fall all along the spectrum of certainty and uncertainty. We have never done anything like this before. There are a lot of things that are very new about fracking, so let me talk about some of those unprecedented things first.



One of the things fracking does is shatter large amounts of bedrock a mile or so below





*Water withdrawal site in Ulster, PA.  
Image courtesy of David Walczak,  
member, Coalition to Protect New  
York*

our feet. It does so by pumping the bedrock full of toxic chemicals and large amounts of water. What fracking does that humans have never done before is make water exit the water cycle. You take four to six million gallons of water per well (in Texas, fracking requires more like 13 million gallons of water per well) and you use that as a sledgehammer to smash the bedrock. Some of that water comes flying back up with the

bubbles of gas that are liberated in that detonation, but most of that is trapped and entombed in deep geological strata, miles below the water table. That water, wherever it comes from (it may have been groundwater itself, or it may have been taken from surface water) will never be seen again.

At a time of climate crisis, when we know that we're facing a shortage of fresh water (already a tiny percent of all available water on Earth), we're taking huge amounts of water and making it disappear entirely. That water will never again flow from a tap. It will never be sap from a tree, juice of an orange, or blood plasma. Since Earth was created, water has flowed from groundwater to rain, from streams to oceans, and along the way it becomes tears, blood plasma and urine. It's a big wheel of water. Fracking, for the first time in the history of the planet, makes water vanish. That's one thing we know will have consequences for future generations.

There are also threats to groundwater. In New York state, there are thousands of unmapped and abandoned wells from vertical drilling operations that have gone on for more than 100 years. Those are like little cocktail straws that go from the surface of the earth down into the bedrock, and can serve as portals of contamination. The concern is that by injecting very toxic fluid at high pressure, it could come squirting up through one of these openings. We know they're out there, but we don't know where they are because no one ever bothered to map them.

All of this requires burning tremendous amounts of diesel fuel in order to generate that kind of pressure (10,000 pounds per square inch), to carry the chemicals and all that water to the site, and to carry away the toxins that come back up.



We know with certainty that fracking contaminates the air. We have very good data from places in the gas field. Formerly pristine air in places like Wyoming and eastern Utah now has ozone levels that approach or exceed those in downtown Los Angeles. We know with certainty that there are health effects from ozone. Ozone is a

powerful poison, and it has the power to stunt lung development when exposure happens early in life. Infants and children exposed to smog will grow a smaller set of lungs than unexposed children. That means less respiratory surface area, which raises the risk of asthma and other problems later in life like chronic pulmonary obstructive disorders.

In older people-whose lungs have already stopped growing-ozone has the

...that people whose lungs were already weakened by smoking have the power to punch holes into the alveoli (the gas exchange surface of the lungs) and cause inflammation in ways that can raise the risk of heart attack and stroke. Breathing in smog or ozone shortens lives and is disabling to the respiratory systems of children. We know that fracking operations contribute to ozone creation, and we know that this has health effects.

There are other concerns, such as earthquakes. We see these swarms of earthquakes, associated not so much with actual fracking, but with the subsequent injection of fracking fluids into deep wells.

These are uncertainties that need to be researched, but the question is, who gets the benefit of the doubt? Should it go to future generations and children, or should it go to the drilling operation? There is no way of testing this on some other planet. We don't have a laboratory in which to try these things out. If we shatter the bedrock of our nation, there's no way to put it back together. With the Deepwater Horizon, which was a problem that was difficult to solve, at least they were eventually able to plug the hole. We won't be able to go back and repair the damage we create through fracking. If we discover that it's a terrible idea and that it's releasing radiation and contamination into groundwater, there's no remediating it. That's also why I'd identify it as the most serious of all of the polluting activities that we're doing. The possibility of creating a pipeline of unstoppable consequences is very great.

**Have non-discloser agreements that property owners sign with companies doing the drilling affected the ability to research the impacts of fracking on ecosystem and human health?**

The secrecy that surrounds fracking makes it very difficult for those of us in the research community when we are approached by communities that want to know, for example, if the health effects they're seeing in their farm animals or pets might be related to chemicals that appear to be in their ponds, streams and perhaps drinking water. Because of the information that is held as proprietary secrets, it's hard to give information to people. It blinds those of us in the scientific community from being able to answer questions.

That being said, I don't think the answer is simply to compel the fracking industry to reveal what it is using. I don't think it's sufficient to simply tell people what they're being poisoned with; I think we just need to stop poisoning people.

The larger issue is our energy economy. The best science shows us that continuing on the pathway of turning on the lights with fossil fuels is killing people and killing the planet. The capital investment in new forms of energy should not be directed toward natural gas. "Natural gas" is a euphemism for methane. Natural gas simply refers to a vaporous form of petroleum. Unburned methane is one of the most powerful greenhouse gases we know of. It is 23 times more powerful at trapping heat than carbon dioxide. Inevitably, when you blast bubbles of methane-a vapor-out of the ground, some of it will leak and enter the atmosphere.

Fracking is a tremendously expensive operation that requires industrializing rural landscapes, which involves building a whole



infrastructure of pipelines, road, condensers and compressors. All of that effort and job creation could be directed down other pathways, such as solar and wind, which is what I'm in favor of. So while I'm certainly in favor of the fracking companies being public about the chemicals they're putting into the commons (the earth, air and water we all share), I don't think that is sufficient. I think they should just stop.



**Some communities have been able to ban hydrofracking. Some say the key factor is an educated populace. Do you agree? If so, what's the best (and fastest) way to do that?**

Certainly, there are many community-wide bans here in upstate New York. Those occurred because our previous governor had personal reservations about fracking and what it could do to communities. As one of his last acts of office, he declared a one-year moratorium on fracking until research was done to understand the environmental and human health effects of this operation. So, unlike the rest of the nation, New York was given a year to study it.

What then happened was that small communities who live on top of the shale (and I live in one of those communities) became aware not only of the dangers of fracking, but of what they could lose. They weren't just concerned about fracking threatening their health, but also with the industrialization of a rural landscape; on top of which are cows and vineyards that provide a lot of jobs and are part of the beauty of the landscape which makes this an area for a lot of recreation and tourism. People began to look at the economic issues of what would be lost, and to realize that if there's a gas boom, there will eventually be a bust. The gas will run out sooner or later and we'll be left with a ruined land—no thriving dairies, no artisanal cheese, no wine, and no water.

So many communities, including my own, have decided "no." We have passed referendums and resolutions, not banning this specific industry, but declaring that heavy industry is not part of the vision we have for our community. The gas industry claims that it will sue all of these communities and win because we do not have the right to regulate their industry. That can't be done at a local level; only a state level. The response has been, "We're not trying to regulate you. We're trying to ban you. We don't want you here." What will happen remains to be seen because the court hasn't ruled whether or not these bans will hold up.

We need a nationwide moratorium on fracking. This cannot be done town by town. First of all, there is an unfairness factor. The towns that don't have the time, education and money to look into it are going to be fracked, and those will be places where poorer children live. It can't be that the ability to keep fracking out rests with all of these little town boards.

We need national leadership. When the industry was developing fracking techniques, they were clever to succeed during the Bush administration. They received federal exemptions from many of our environmental laws. That is why the EPA has little jurisdiction over this kind of energy extraction. In fact, Washington insiders refer to those exemptions as the "Halliburton Loophole." Halliburton was one of the companies that

Hamburton Loophole. Hamburton was one of the companies that pioneered fracking. The Clean Air Act, the Clean Water Act, the Safe Drinking Water Act, the Right to Know laws don't fully apply to fracking. That has left the states to regulate it. States like Pennsylvania have opened the floodgates to the gas boom and see it as an economic engine. Here in New York, because of this serendipitous act of our former governor, we had time to think about it. The more time communities have to think about it, the more appalling it seems. There's an unfairness in that. Given that fracking relies on chemicals that are known to cause cancer and birth defects, and are linked to asthma, miscarriage, preterm labor, and learning disabilities, and given that these are very expensive problems, there needs to be a nationwide debate about this. It seems very likely that when we quantify the full costs, the benefits of fracking would look very different. The costs that we already spend on things like asthma and preterm birth are billions of dollars a year. That's part of why we have out of control medical costs. Twenty-two percent of all taxpayer

dollars that fund our public school system goes toward special education services now. Putting more brain sabotaging chemicals into communities is only going to exacerbate those kinds of problems.

### **Have there been nationwide moratoriums on fracking in other parts of the world?**



*Sandra Steingraber addressing the European Parliament. Image courtesy of [Sarah Horton](#).*

France has banned fracking nationwide. I went to France in November of 2010, when the news of plans to frack in beautiful parts of southern France was first hitting the press. People were just beginning to become outraged. Having just come from the U.S., fresh from the fracking battles here, I was eager to share what I knew. I went from there to the European Parliament, where I gave a talk in Brussels about cancer and the environment and talked a lot about fracking.

At that time, fracking was a new idea to a lot of the French public. I met with leaders of some of the European environmental organizations, and it was also very new to them. But they went from just learning about it in December to a decision this summer to ban fracking in France. I was very impressed with the ability of French political leaders to look at the dangers fracking would create for the country's wonderful agricultural system, as well as air, water, and public health. They decided that harming people in order to get gas out of the ground was not an acceptable tradeoff.

As a biologist, it's interesting to me to see one society take a look at the same data and very swiftly say, "This is not worth the risk." We have the same data available to us here, but it's being played out very differently.

### **Is France a place where the Precautionary Principle effectively guides policy? In France, does the burden of proof rest with the industries that stand to gain from operations, rather than on the public?**

I think that's true of European nations in general. The precautionary principle is actually enshrined into the constitution of the European Union.



This is my opinion: Where you have national healthcare systems, governments pay attention to the healthcare costs. Because healthcare is being paid for with taxpayer dollars, everyone is in it together. Activities that private industries want to do that might threaten public health and increase healthcare costs down the road, immediately become part of the above ground conversation. Here, there are metrics for, say, the number of jobs an industry might provide, but the amount of money we would spend on all the cancers and additional asthmas and learning disabilities—those costs are not on the front pages of our newspapers here. They tend to be more hidden. That being said, fracking has not been banned across the European Union. The debate still goes on. Poland, for example, would like very much not to rely on Russia for national gas. There are a lot of big, geostrategic energy things happening in Europe and I don't pretend to know all of the issues in every nation.

**World War II dramatically changed the rate of production of synthetic chemicals, many of which are still circulating, untested. What about chemicals or other substances developed more recently?**

There is a lot of secrecy around chemicals invented for wartime purposes, so we may not even know what those are. Because World War II truly was a world war, it involved a lot of blockades. It became impossible, for example, to get Japanese silk, so nylon was invented for parachutes. Germany lost its ability to get Chilean saltpeter for fertilizer so they invented synthetic fertilizers that could also be used as explosives. The overlap of those two things became obvious when someone who had access to fertilizers used them to blow up the Federal building in Oklahoma City.

Since then, we haven't had a war that filled up the whole world all at once. But certainly, in the 1940s, that was the catalyst for substituting synthetic chemicals for what had previously been a lot of botanicals. We relied on carbohydrates and animals for things we do not get from oil and natural gas.

This is why I'm so focused on fracking now. Natural gas is the starting point for a lot of the chemicals that I, along with others, have been very concerned about. One of them is PVC (polyvinyl chloride), which is one of the main sources of dioxin in North America. Burning PVC plastic is a leading creator of dioxin. For workers, PVC is very toxic because it relies on a chemical—vinyl chloride—that is not only very explosive, but is a known carcinogen. A PVC factory near my hometown in Illinois blew up in 2004, contaminating a large area with dioxin and killing a lot of workers. My investigation of that terrible chemical accident, one of the worst ever in Illinois, is in my most recent book, [Raising Elijah](#). It's important to realize that the starting point for PVC is natural gas.

Natural gas is also the starting point for anhydrous ammonia, a synthetic fertilizer which is basically what the whole industrial food system runs on.

Whether we live in an area that's being fracked or not, all of us who live in the U.S. are invested in whether or not we go down the road of fracking. By lowering the cost of natural gas, we lower the cost of everything natural gas makes, which is not just heating our home. It is used as a feedstock. the starting point for a lot of dangerous chemicals. If we're

...reaching, the starting point for our dangerous chemicals is not interested, for example, in divorcing agriculture from chemicals (synthetic fertilizers) which are contaminating our groundwater, putting a dead zone in the Gulf of Mexico, and allowing cheap commodities like corn and beans to form the basis of our cheap, junk food system, the starting point is natural gas. If we want local food, and we want kids to eat healthier, and we want carrots to be cheaper than Twinkies, then fracking is part of the story.

Fracking is the root of not only our energy system, but part of our materials economy. It's hard to imagine that something that is an invisible vapor (methane) may be the starting point for the credit card in your wallet which is made of PVC. The vinyl siding on your house, the garden hose, the Barbie doll...all of these things are petrochemicals. Helping people see that chain of material is part of what I see as my task as a writer in this moment in history.

**I was going to ask you which, of all of the known toxic chemicals present in our environment, you consider to be "enemy number one" but it sounds like you'd give this label to natural gas? Am I right?**

I would label natural gas as enemy number one right now. In a previous time, it would've been something else.

Here in Ithaca, for example, we have a toxic site downtown. It creates a terrible problem because it's part of a historic neighborhood and there are all kinds of beautiful buildings above this site, but it is the site where a factory used to exist that turned gasified coal into a gas that was used to light streetlamps.



I was born in 1959, a full century after the Ithaca Gas Light Company opened for business. I have no idea what gas streetlamps look like. Yet the generation that turned coal into streetlamp light left behind this toxic legacy that everyone in my generation and my kids' generation has to pay to clean up. I felt compelled to pull my daughter out of ballet lessons because the ballet studio was located near this site, and we now understand the soil is contaminated and there are toxic and carcinogenic vapors that emerge from there. So now we're using natural gas as the starting point for carbon, and we're making stuff that, in another hundred years, may be entirely obsolete to people who come after us. But their kids are going to be paying the price for all the shattered bedrock, the contaminated water they won't be able to drink, the fragmented landscape that won't have the abiding life support system that we need to live there. Living in a place requires pollinators. It requires organisms like frogs and bats to keep the mosquitoes down. Fracking is throwing a barrage of poisons at all of those ecosystem services. We're damaging the life support system, not just for ourselves but for generations to follow.

It's hard enough to go into a historic neighborhood and get rid of these toxic chemicals that are vaporizing through the soil from 100 years ago. How are we going to do it if it's coming up from the bedrock a mile below our feet? How would we ever fix that? We don't have a solution for that

our feet? How would we ever fix that? We don't have a solution for that.

To me, one of the most fundamental obscenities of fracking (and there are many of them) is what it does to water. There are two crimes here. First, fracking entombs large amounts of precious fresh water deep into geological strata and removes it from the water cycle forever. Second, the water that does come back up the borehole is permanently damaged in a way we don't know how to fix. We don't know how to turn frack backflow into drinkable water again. To me, fracking is not a revolutionary technology. It's regressive. It's creating poison in order to turn on the lights. It's a 100 year old experiment that has failed every time.



Happily, green chemistry and green engineering show us that a whole other world is possible that is revolutionarily different. It relies on wind, solar, and things that don't destroy the functioning of the biosphere. The best science shows us that we could entirely run the economy on renewable energy, creating jobs along the

way and getting ourselves off of fossil fuels entirely within a 30-year period if we are willing to cut our energy consumption by half. Europeans already consume half the energy per capita than Americans do; therefore, it's a doable goal and it won't change our so-called lifestyle.

### **How do we get there? Is policy change the answer? If so, how do we conquer the perceived conflict between new regulation and job creation?**

First of all, there is no conflict. Every time we have pursued federal regulations, jobs have been created, not destroyed. Every time we close down dirty industry, there are opportunities for green collar jobs. I think it's a false debate.

As a biologist, I'm really interested in getting lawyers, economists, accountants, and all kinds of folks together to figure it out. As I often tell my audiences, at this moment in history, we have a really complicated problem. Our economy has become ruinously dependent on fossil fuels, both to run our materials economy and to run our energy systems. That has a distorting effect on our foreign policy, it is adding to our healthcare costs, and it is destabilizing the climate to the point where we won't be able to grow enough food to feed a growing population on Earth. This is a very complicated problem, but it's solvable. It's an all hands on deck moment, and it can't be solved by each individual trying to green our own household. But there are historical precedents for our current situation. When our economy was ruinously dependent on slave labor, we required a national policy change, a whole new economic arrangement, not just each individual pledging that they won't own or buy a slave.

I take a lot of inspiration from the abolitionist movement. The early abolitionists, especially in the 1830s, who were speaking out against slavery at a time when investing in slaves was like investing in real estate in the 1990s. A lot of people in slave owning states invested much of their personal wealth in slaves. Millions of dollars in personal wealth was held up in slaves. To say that all slaves will be free tomorrow meant you were going to wipe out all of this wealth. It meant that all of these slaves would

suddenly be free and would need jobs and housing, and who knows what would mean in terms of social unrest? It was thought to be an idea that was beyond the bounds of thinkable thought.

The abolitionist for whom I named my son, Elijah Lovejoy, made the argument that in spite of the way slavery allowed all of us to buy goods at lower prices and made us competitive on the world market, and [despite the fact that] people had their wealth bound up in slavery, it was a homicidal abomination that had to stop. For that, he was pumped full of five bullets in the free state of Illinois by a pro-slavery mob. Nonetheless, his words lived on. They influenced the young Abraham Lincoln, who was beginning to practice law; they influenced Harriet Tubman, John Brown, and Harriet Beecher Stowe, who went on to write Uncle Tom's Cabin, which changed a lot of hearts and minds.

At this moment in history, those of us who believe it's time for us to divorce our economy from fossil fuel in the way, previously, we had to divorce it from slavery, are looked at in the same way – with great derision, as though we were living in a fantasy world. Yet the science is on our side. Future generations may look back on those now working for emancipation from fossil fuels in the same way we look at the heroic abolitionists of the 19<sup>th</sup> century. I want to be judged as that kind of person. To use another analogy, I don't want to be thought of as "a good German" who refuses to see the signs of atrocity around me. I want to be thought of as a member of the French Resistance.



**Your analogies are very effective, especially in your writing. Let's talk about the power of words-both said and unsaid. In Living Downstream, you wrote:**

***"Amid a flood of information, an absence of knowledge. Amid a thousand computer-generated words, a silence spreads out."***

**The theme of silence-in various forms- is woven throughout that book, beginning with your reference to Rachel Carson's Silent Spring. You even named one of your chapters "Silence." Talk about the role of silence in the link between ecological and human health.**

It is certainly present in the relationship between doctor and patient. In 1979, at the time of my own cancer diagnosis, I was asked by my young urologist questions about my possible environmental exposures. It turns out that this is an unusual experience. Most cancer patients don't talk with their doctors about the environment in which they grew up.



Instead, doctors tend to ask about family history. That's the conversation I'm more likely to have with my physicians. It's always fun for me to talk about my family medical history. Doctors are usually very interested in the facts that my aunt also had bladder cancer, that I went on to get colon lesions in my 30s, that I have family members who have colon cancer, that my mom had breast cancer





the same time I had bladder cancer, and that I have another cousin who just died of breast cancer, and on and on. Then, when I reveal that I'm adopted, there's lot of blinking that goes on, as though "that does not compute."

There's a presumption that what runs in families runs in genes and that cancer is a result of hereditary predisposition. In fact, when you look closely at that presumption, it begins to disappear. Most of the data show us that shared environmental experience, rather than shared genes, is a contributing factor. Even when you look at the body of evidence, which is fairly slim, on cancer among adoptees, you see that the chance of an adoptee dying of cancer is far more related to whether or not his or her adoptive parents met that same fate than it is to deaths of a biological parent. In addition, we know from twin studies that gene expression changes with time, and twins become less and less identical over their lifetime, especially if they live in different environments. The environment alters the way the genes behave.

The new thinking in science takes us away from the old, Cold War-era image of the DNA as the master molecule in the cell, flipping all the switches. We now see our genes as keys of a piano, with the environment as the hands of the pianist. You can play jazz or you can play Bach. That depends on the musical score and the musician. Our genes are really responding to environmental cues. They're two partners in a dance. We can't change our ancestors, but we can change the chemicals that we put into the environment. That's why I think that environmental reform is a meaningful place to begin cancer prevention.

There is a lot of scientific research on the role of environmental carcinogenesis, so there's not a lot of silence about that in the world of science. But there is silence in the experience of a cancer patient. It's hard to be part of that conversation because it hasn't entered the world of the doctor-patient relationship. To an unfortunate degree, it also hasn't entered the world of cancer patient advocacy. The American Cancer Society, for example, is largely silent on the issue of the environment. So if a cancer patient newly diagnosed should turn to any of the fairly well-written pamphlets produced by the American Cancer Society, the word "environment" rarely appears there. I've been a cancer patient for 32 years, and I've logged a lot of hours in hospital waiting rooms and doctors' offices and I'm always surrounded by American Cancer Society literature. For years, I challenged myself to find the words "carcinogen"

and "environment" in any of their literature. For many years, I couldn't. Now, it's beginning to show up, but in a fairly dismissive way. I don't think the popular public educational literature on cancer adequately and accurately represents the state of the science on what we know about cancer and the environment.

That is really what prompted me to write [Living Downstream](#). As a writer, I wanted to describe the state of the evidence for my readers, and for that book, I defined them as cancer patients or the people who love them. I wrote out of my identity as a cancer patient and told the story of my own diagnosis and the fact that I was only one data point in a larger cluster of cancer in the toxic hometown where I grew up. I wanted to use that narrative to hang a very accurate and plainspoken description of

what we know about cancer and the environment. It was published in 1997 and then updated in 2010. It's a much thicker book now, as the evidence has gotten a lot stronger.

**In Raising Elijah, you discuss the term "well-informed futility." In Living Downstream, you say that as a cancer patient, you know how to "stop dithering in uncertainty" and "unparalyze" yourself and take action. How can we, as designers, engineers and restoration ecologists, unparalyze ourselves?**

I'm thrilled to talk to this audience because I don't see you as paralyzed! Essentially, what we have is a design problem. We have designed a food system, an energy system, a materials economy that is toxic and has human rights consequences. We are using people's bodies as the final repository for all these toxic byproducts in order to bring food to the table, in order to bring consumer goods to market, and in order to turn on the lights. So we have a design problem. Designers who are providing solutions are the antidote to despair.

There's nothing better for me as a writer than to say, "here's the evidence for harm, but this is all needless, because these green engineers, organic farmers, designers know how to make carbon-neutral housing; they know how to make wind turbines that don't kill bats; through biomimicry, they can create systems of synthetic chemistry that don't require the generation of toxic byproducts that have to be shoveled into a hole in someone's backyard, only to leech into their groundwater or waft up as vapors in their basement.



Designers are my heroes, along with organic farmers and everybody else who is figuring out how to do it better. Showing people that there are solutions. Right now, these solutions may occupy the margins, but they could, with a little capital investment, become the normal way of doing things is very exciting. For my readers and people in my audiences, no strategy works better to get them unparalyzed than to realize that there are solutions out there that we just need to insist upon.

**Earlier, you said that we are in an "all hands on deck" moment and you mentioned the need for cross-disciplinary collaboration. To what degree do you see the medical community (both professional and academic institutions) collaborating with environmental scientists (and vice versa) to influence policy?**

I'd say it's a patchwork. I'd like to see more collaboration. Certainly, there are physicians who are on the front lines. In fact, I am confident that we were able to prevent the expansion of a toxic waste site overtop of a drinking water aquifer in Peoria [Illinois] when area doctors showed up at the public hearing. All they really needed to say was, as one did, "I don't need any more patients with cancer in my office. I have enough already." That really tipped the discussion. Up until that point, it almost seemed inevitable that this toxic waste site was going to be able to expand.

When doctors write letters to the editor, and when they raise questions like, "Why is it that so many of my pediatric cancer patients seem to come from this same community? Why are there so many birth defects

of this type in this farm community?" they can serve as sentries and bring problems to the attention of the epidemiologists and toxicologists, who then should follow up. Unfortunately, our system of public health doesn't have that kind of rapid response mechanism in place. A lot of the doctors I talk to feel frustrated because they see these things and they raise these questions and bring them to the county or state health department and nothing is done. There is nothing in the system that means that doctors' observations will be pursued with vigorous research. So that means that doctors can become cynical about the system. I'd like to see that change.

I'd also like to see a lot more environmental health taught in the medical schools. I think it's tough for doctors to even ask the right questions if they aren't familiar with the whole body of knowledge of molecular epidemiology (which shows how certain chemical actors play a role in human cancer). The medical schools could do a much better job at making the connection between health and the environment.

It really all starts at the top. There was a wonderful report that the President's Cancer Panel released in May 2010 (**2008-2009 Annual Report, President's Cancer Panel. Reducing Environmental Cancer Risk: What we can do now.**) I was able to testify before the Panel as they took up the question of cancer and the environment. They wrote a very strong report, which is a summary of the evidence. They came to much the same conclusions that I came to in Living Downstream, which is that the burden of human cancers attributed to the environment has been grossly underestimated. The Panel even took the unusual step of submitting the report to President Obama along with a letter urging him to use the power of his office to remove carcinogens from air, food and water because environmental cancers were adding to spiraling health care costs, undermining the productivity of U.S. workers, and creating suffering and death. That report was entirely ignored by the administration-no

response at all. In fact, when I had the opportunity to meet with White House staff, along with a couple of other epidemiologists and a physician who also provided testimony, we were basically told that there would be no response to the report. I thought that was really stunning. The response from the Obama White House was very different from the response the three of us received when we did a Congressional briefing. There was a packed room on Capitol Hill and a lot of interest among legislators and their aids about policies that could be created that would save lives and reduce health care costs based on what we now know from this very good report. But I have seen absolutely no action.

**It is often very difficult for scientists to communicate with a broader audience. Your writing, particularly in Raising Elijah, was laced with surprising bits of humor. Have you found humor to be an effective tool in the communication of very serious environmental health information?**

I really have, and I'm glad you asked that. Of the three books I wrote on environmental health, Living Downstream is the most serious and earnest of them all. I tried out a little comedy in my next book on environmental threats to pregnancy, Having Faith (named after my daughter, Faith). That came out of a struggle as a writer to write about something that felt even more taboo than writing about cancer and the environment, and

that was chemicals that may sabotage pregnancy. My audience would be new and pregnant mothers, and scaring a pregnant woman is not something you're supposed to do. Yet keeping the field of fetal toxicology a secret seemed wrong. We don't want to infantilize pregnant women and think they can't handle bad news. They need to know these things to protect themselves.

So how do we talk about the evidence linking pesticides to birth defects, or certain solvents to miscarriage rates? I decided if I could be funny, that might be the vehicle I could use. Of course nothing is worse than trying to be funny and not succeeding, but it worked so well with Having Faith that I decided to keep on with it in Raising Elijah.

The challenge for me in Raising Elijah was that among all three of my books, it covers the longest time span, and so needed an exciting narrative arc. The story begins with the birth of my son and continues until his ninth birthday. But the day-to-day life of parenting young children is not that dramatic. With Having Faith, at least I had a good plot- the story of a cancer patient who then became pregnant, and laid down on the same ultrasound table in Boston where she had once been scanned for signs of tumors, and has her first prenatal ultrasound. The events of pregnancy are exciting. The opera of embryonic development created some great opportunities for fun, descriptive writing, and of course, there's the big climax with the birth. By contrast, Raising Elijah is about raising two young children, and it's not that exciting. Most of your days are spent doing small, interior, domestic things. I felt like humor was necessary to generate some plot excitement and because I needed to be

able to reveal what seemed counterintuitive. When you're living with small children and you feel very interior and isolated, actually you are bound to some of the biggest policy issues of our time. All of our policies about air, food and water are enacted in a new mother's house every single day, and they affect what she's going to do with her hours because our kids are, more so than us, ecological creatures. Their bodies are made up of the rearranged molecules of air, food and water that flow through our households and we cannot put our own bodies between all those chemicals and the bodies of our kids. Humor is also sometimes counterintuitive, so I thought it would help me reveal those links between the domestic and the public.

**Do you have any final words of wisdom to share with *Leaf Litter* readers?**

Environmental contamination is the human rights issue of our time. The answer is to radically redesign our economy in ways that make it not dependent on fossil fuels. Thinking of our current situation as a design problem makes it feel like it's fixable. I really do believe in the power of human ingenuity to come up with previously unimaginable and elegant solutions to really complicated problems.

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## Leaf Litter Talks With Robert Costanza

It's true, you can't put a price tag good health. But if anyone is equipped to talk about the value of human well-being and how it is impacted by ecosystems, it's Dr. Robert Costanza. In 1997, Dr. Costanza and colleagues broke ground with an article in the journal *Nature* that attempted to quantify the economic value of the natural world. Co-



founder and past-president of the [International Society for Ecological Economics](#), Dr. Costanza is now University Professor of Sustainability and Director of the [Institute for Sustainable Solutions at Portland State University](#). He is also founding editor in chief of [Solutions](#) a hybrid academic/popular journal. Previously, he was Gund Professor of Ecological Economics and director of the [Gund Institute for Ecological Economics at the University of Vermont](#).

Dr. Costanza's transdisciplinary research integrates the study of humans and the rest of nature to address research, policy and management issues at multiple time and space scales. His work has garnered awards

such as a Kellogg National Fellowship, the Society for Conservation Biology Distinguished Achievement Award, a Pew Scholarship in Conservation and the Environment, the Kenneth Boulding Memorial Award for Outstanding Contributions in Ecological Economics, and honorary doctorates from Stockholm University and the Ecole Normale Supérieure de Lyon. Dr. Costanza is the author or co-author of over 400 scientific papers and 22 books. He is also currently a Distinguished Research Fellow at Ecological Economics Research center New Zealand (EERNZ), Massey University, Palmerston North, New Zealand, a Senior Fellow at the National Council on Science and the Environment, Washington, DC, and a Senior Fellow at the Stockholm Resilience Center, Stockholm, Sweden.

**A great deal of your career has been focused on the valuation of biodiversity and the services provided by ecological systems. Can you tell us about any new or recent research related to the health costs associated with degraded ecosystems?**



I just returned from China, where we are setting up a joint research center with the [Chinese Academy of Sciences](#) on ecosystem services. One of the things they are very concerned with is air quality, particularly around Beijing. Part of the problem there is the dust that blows in from the Loess Plateau, which is the result of the lack of

vegetation to hold the soil. There is a massive replanting program there to reestablish vegetation that will hold the soil, which will improve air quality, which will contribute directly to human health in Beijing.

There is a perceivable connection between ecosystem health and human health, and there is a lot of research going on around the world these days on the complexity of that connection. Part of the challenge is that the connection is not very direct. It's not as easy to see and make policy

the connection is not very direct. It's not as easy to see and make points on as some other issues. There is a certain amount of scientific research that has to go into establishing, understanding and modeling that connection. As we develop better methods to do that, we get a better handle on how those connections work. Think about smoking and health. We didn't realize the connection between smoking and lung cancer for quite a while. Epidemiological data established that connection, and then the tobacco industry fought those findings for a long time.

It's amazing how far we've come in terms of our ability to observe, model and understand some of these complex connections between how natural ecosystems function and human health and, more broadly, human well-being.

The health aspect is important, but the other side of this is the better understanding of human psychology and what actually contributes to people's well-being, or quality of life. That research goes well beyond the conventional, economic paradigm which can be summarized as: "the more stuff we have, the better off we are."

We can now actually observe people's brain function and see what parts of their brain light up when they're happy. We can observe-almost directly-what causes people to experience happiness, and it's actually much more related to giving than taking. Being a part of a well-functioning social group causes some people to be happy, so social capital contributes a lot to people's sense of well-being. Being out in nature contributes to well-being. Health, or how people feel individually, certainly also contributes to a sense of well-being.

Better understanding all of those complex connections is needed if our goal really is to create a world where humans can thrive sustainably.

**You have said that the real purpose of economy is "to sustain human well-being." How badly is the conventional notion of economy failing in this purpose, and what will it take to get others to define the economy differently?**

The notion of a rational economic actor, which has been the basis for a lot of economic theory, is rapidly being eroded as we recognize that that's just not the way people behave. In fact, there have been some experiments that have shown that the only people who behave that way-super rationalistic and individualistic-are economists.



The reality of the situation is much different. We're learning a lot more about how people really behave through the "science of happiness," positive psychology and behavioral economics, and experiments about how people really behave in certain situations.

There is also the growing recognition that there are different types of goods and services that require different kinds of institutions to manage. Markets work pretty well for private goods, but lots of things that are important to human well-being, like our natural capital assets and ecosystem services-a good climate and water, for example-are public goods. They need different kinds of institutions to manage them.

**Speaking of public goods...you recently participated in a roundtable session with Elinor Ostrom, known for her analysis of governance of common property (and for being the first female recipient of the Nobel Prize in Economic Sciences). Tell us about that.**

We had a great workshop on the topic of common property and managing ecosystem services (the results will be published in the Nov/Dec issue of *Solutions*). Her point is that for many of these common pool resources and other kinds of public goods, we need different kinds of institutions. People have historically developed those kinds of institutions, largely through participation and cooperation, not the typical competitive market model that underlies a lot of conventional economic thinking.

At the micro level, there are a lot of good ideas coming out of that. If we're going to better manage common property resources, we're going to need different kinds of institutions that recognize how people actually behave.

At the macro level, we also need to recognize what our goal really is and what our measures of macro behavior are in order to measure progress toward that goal. Take Gross Domestic Product (GDP), for example. GDP was never designed as a measure of economic well-being. It really only measures economic activity, and some of that activity is not necessarily what we want. The GDP doesn't subtract any of the bad stuff from the good stuff. If there's an oil spill, someone has to go clean that up. That's more activity, and that leads to more GDP, so that's "good for the economy?" But in reality, we would have been better off had we not lost those resources in the first place.

There have been some attempts to redefine those goals. One is called the Genuine Progress Indicator (GPI). It tries to adjust GDP and ask "what is the net benefit?" It starts with personal consumption, but then it weights that by income distribution, which is a huge factor in determining societal well-being. There is a book called [The Spirit Level](#) (by Richard G. Wilkinson and Kate Pickett) that plots the relationship between income distribution and a whole range of social problems in different, developed societies. It shows a very strong correlation. The worse the income distribution, the worse the problems. So there is a direct effect on well-being, and health is a part of that. Obesity, longevity...all of those things are correlated with wealth distribution. The GPI includes that. We know that a dollar's worth of income to a rich person doesn't produce as much additional welfare as it does for a poor person. The GPI adjusts for that. It also adds things that are left out of GDP, like the value of household labor and volunteer work, and subtracts a bunch of things that are in there and shouldn't be, such as the cost of crime, the loss of natural capital from air and water pollution, etc. The GPI is not a perfect indicator by any means, but it's certainly a lot better approximation to a real indicator of welfare rather than just activity.

**Who is using the GPI?**

The state of Maryland has adopted the GPI as one of their official progress indicators. Other states like Vermont and Oregon are considering it. What's interesting about the GPI is that it shows a very different picture [than GDP] of what has happened in the last several decades. In the U.S., with the exception of the last few years, GDP has been going up quite

with the exception of the last few years, GDP has been going up quite exponentially. The GPI was highly correlated with GDP from around 1950-1975. But since 1975, GPI has been relatively flat while GDP has been growing. All the negative components, the costs of that economic growth, are now beginning to outweigh the benefits.

What are we really trying to achieve? Do we want *genuine* progress-greater quality of life and human well-being-or do we just want to produce more and more stuff? Most people would agree it's the former, but we've kind of lost sight of that. We've become addicted to this model of growth at all costs, and that needs to change.

**It's been 14 years since your landmark paper, "The value of the world's ecosystem services and natural capital" was published in *Nature*. Were values of health and mental health benefits delivered by nature included? If so, how have they changed since then?**

They were included in some of the studies that we synthesized as part of that paper. Certainly, you could argue that they weren't completely or adequately included. The science is progressing quite rapidly, so there is much better recognition now of some of those connections. I don't think we'll ever pinpoint all of them with a high degree of accuracy-or that we'll necessarily need to.

We need to recognize that those connections exist and also acknowledge our current and ongoing ignorance about what exactly the connections are and how big they are. But then we need to try to err on the side of caution instead of waiting to "prove" before we act. That's another major shift that needs to occur. We need to change the burden of proof away from the public and towards the parties that stand to gain from a particular activity.

One idea we've proposed to address this is the idea of an environmental assurance bond. When there's a new activity being proposed, the proposer should post a financial bond large enough to cover the worse case damage. Then, it's the responsibility of the proposer to either demonstrate that those impacts are not going to happen, come up with a different process that is not inherently as risky, or recover some fraction of the bond when it's clear that the worst case has not occurred. There is a paper in *Solutions* titled "[The Perfect Spill](#)" about the BP oil spill and how we might prevent those kinds of things from happening in the future if we implement that kind of bonding system. If BP had to post a bond to cover the worst case damages-and we now have a pretty good idea what they are-they would've been a lot more careful in how they drilled. They may not have even done it at all because of the inherent risks and potential damages to society at large. We need to get those risks to the environment and society onto the table so that the economic actors and agents are required to take them more fully into account when they make decisions.

Nuclear power is another major area where this kind of idea could be implemented. We had [a paper on nuclear power in \*Solutions\* about the Fukushima Daiichi disaster](#) and how that might motivate us to incorporate the full cost-including the risk of accidents and the cost of waste disposal-into the price of electricity from nuclear power. If you did that, you'd see that nuclear power is not cheap.



## **What are some of the things you're working on right now?**

I'm working on a scenario planning exercise for the state of Oregon.

We're plotting out some plausible alternative futures going into the next century and putting these alternatives back out to the public in the form of a survey that asks, "What kind of future do people in Oregon really want?" We want to get the full range of possibilities. People don't really recognize the choices we need to make right now and what the implications of those choices are.

We're also working on ecosystem services and natural capital—all the benefits derived from natural ecosystems—and how to quantify, model and use that information to better manage the systems. In November, we're doing a special issue of the journal *Solutions* on ecosystem services. We will explore how ecosystem services have contributed and could contribute to solving the problems of managing our natural resources sustainably for the benefit of everyone—now and in the future.

**You have spoken about the need to create a new economy; a new system that could sustain itself. You stressed the need to first create a positive, shared vision of such a system – something you say the environmental movement has failed to do. You said, "The worst thing you can do when trying to help an addict overcome their addiction is them they're doing the wrong thing. That immediately causes a defensive reaction."**

**Can you articulate your vision? Does the connection between ecological and human health factor into that? How will your vision overcome the failure of the environmental movement in the past to present something positive?**

There is [a piece in \*Solutions\*](#) in which I attempt to articulate that vision as a narrative. The way we usually end up articulating these visions is through graphs, charts, and numbers, and that doesn't engage very many people. To engage the general population, you really need to create a much more vivid narrative of what life would be like in these alternative futures. That's what I tried to do. I hope we can do a lot more of that.



Scenario planning is one approach to that. Instead of having one vision of how we really want things, this process involves creating a number of alternative, plausible future scenarios. Often, it ends up being four different scenarios, because that's how many people can handle, and it also usually covers the spectrum of possible futures. We

say, "Here's how the future could be, and which of these futures we end up in depends a lot on the choices we make right now."

We are trying to do this here in Oregon, and I think we can do something like that at multiple scales. Businesses use this process quite a lot to do their future planning. In fact, it started with some work at Shell Oil back in the 1970s and was applied in post-apartheid period in South Africa very effectively.

These visions need to be fleshed out in detail and with enough vividness so that people can imagine themselves living there. That's a challenge for

so that people can imagine themselves living there. That's a challenge for scientists, certainly. That's an area where collaboration among scientists and filmmakers, writers and others who can vividly paint pictures will be important.

I'd like to see some Hollywood movies that are set in a sustainable, desirable future, rather than the dystopias we always see. If we can show people some possibilities, then we can start to work out the details. We can start asking, "What does this mean in terms of people's quality of life, jobs, livelihood, and human health?" We can create a society in which people are healthier, live more fulfilling lives, and have more job security and more fulfilling jobs. Maybe they aren't working as hard. Maybe they're not consuming as much stuff. But maybe that's not what they need. It's probably a world in which the distribution of income is narrower, where people are consuming less material goods, but spending more of their time engaging in social interactions.

That theme comes out in many of the articles in *Solutions*, including [one by Jeffrey Hollender, the former CEO of Seventh Generation](#).

### **How important is the integration of academic disciplines in the development and communication of future scenarios?**

It is extremely important, because I don't think any one scientific discipline can solve these problems. We have to think about an integrated picture. If you're designing a future world or trying to plot multiple scenarios, you have to look at how that whole system functions. In order to describe it, you're going to need more communication skills than the average academic brings to the table.

That's one of the things we're trying to do with *Solutions*. We're trying to get transdisciplinary teams to write the papers, but also engage journalists and writers.

### **To what degree do you see the medical community (both practitioners and medical schools) participating in these visioning workshops and exercises?**



I think they are extremely important participants. Individual human health is a major component of people's sense of well-being. We have to learn how to improve that and do it in a way that are much less resource intensive and more sustainable.

I've been involved with a group called [Ecosystem Health](#), which puts out a journal ([EcoHealth](#)) which focuses on just those kinds of linkages. We're already finding, for example, that climate change is already having a huge impact on mortality and morbidity around the world. If we can quantify what that impact has already been, then conversely, we can look at the

benefit of preventing further deterioration of the climate.

All of these things are connected, yet our academic institutions are not very connected. They are split up into disciplinary silos. One of the things we're trying to do here at the [Institute for Sustainable Solutions](#) is to overcome that by being a catalyst to better integrate all of our intellectual

resources.

One of the most effective ways of doing this is through "problem-based" courses. The idea is to focus on the problem a community faces and bring together stakeholders, students and faculty from the multitude of disciplines that impact that problem, and actually try to solve the problem on the ground. It requires blurring the boundaries between academic research, teaching, outreach and service. Everyone works together to solve a common problem, rather than defending their intellectual turf. I think that's an effective way to overcome barriers and engage people from the medical community—or any community that bears on the problem at hand.

### **How are issues like environmental justice and women's rights folded into the development of a vision for a desirable future?**

Going back to what contributes to human well-being, one of the core things that we haven't adequately recognized is the issue of fairness. People are much happier, and can build social capital much more effectively, if they feel like the system is fair. So issues like environmental justice, ethnic diversity, and income distribution are all critical towards creating a more sustainable, desirable society.

There have been some very interesting experiments with something called the "[ultimatum game](#)." It's a lab experiment involving, for example, ten dollars, and two people. One person is given the money and instructed to propose how to share it with the other person. If the other person agrees to the proposal, they both get the money. If they don't agree, nobody gets anything. The standard economic model would say you should propose giving the other person one penny. Obviously, one penny is better than nothing and the person should prefer one penny to zero. But in reality, all over the world in all different cultures, no one will accept a distribution that's very far from 50-50. Our desire for fairness is inherent. If there isn't fairness, our ability to build good social relationships, which contributes to social capital, deteriorates.

Conventional economic ideas say, "Let's just increase the size of the pie. If everyone has more, it's not important how it's distributed. The poor will get more as well." But the *relative* income, or relative rates of consumption, affects people's sense of well-being much more than their absolute rates of consumption.

Robert Frank from Cornell has written good books on this, including one called [Luxury Fever](#). He refers to the "consumption arms race." The only reason people want 10,000 square foot houses is that their neighbors have them, not because they need that much space. People's sense of their own well-being is based on their relative consumption of goods like cars and houses. I believe that desire to consume more and more had a lot to do with the housing bubble. There are ways to control arms races. We could tax that kind of consumption



more heavily and reduce it, which would allow people to spend their time on non-conspicuous kinds of consumption, like participating in social goods and providing social capital.

### **How do you define social capital?**

All of the interactions among people, through formal and informal networks and institutions. It's not individual health and well-being, but the health and well-being of groups of people. Your email network is a form of social capital, for example. So is your community at various scales, from your local neighborhood, to your city, to your nation.

We humans are very good at building social capital within our perceived groups, but we're not very good at building social capital across groups. The scale of our living has increased, and we're now at the global scale. How do we build social capital at this larger scale? How to do things that benefit the whole planet is a challenge, but it's not insurmountable. We need to think of ourselves as planetary citizens.

**The journal *Solutions* is intended to be a forum for the discussion and development of "seriously creative ideas" for solving the world's integrated ecological, social, and economic problems. Since the magazine's launch in January 2010, have any of these ideas specifically involved enhancing or restoring ecological systems with the dual aim of improving human health?**

Both individual human health (human capital) and the health of groups of people (social capital) are the essence of some of the benefits of natural ecosystems. The special ecosystem services issue of *Solutions* (look for it in November!) will definitely cover this.

**Is there any place in the world where, in your opinion, natural and social capital are appropriately factored into the economy?**

Scandinavia seems to be much closer than most other places in getting the balance right. They have a much better appreciation of social and natural capital, and the gap in income distribution is much smaller than that in the U.S. There are places *within* the U.S. that are closer to an appropriate balance. Vermont has done a much better job in that regard. Oregon, where I am now, is a leader in thinking about sustainability and

bringing all of these issues—social, environmental and human health—to the table as we strive toward societal well-being.

I recently visited Bhutan, where they have declared that their goal for national development is "gross national happiness," as opposed to gross national product. So there are even some whole countries that are taking a more radical approach. I think that model may have significant influence on much larger countries. For example, French President Nicholas Sarkozy's [ongoing commission on alternatives to GDP](#) has recognized that there is a need for a better measure of progress.

There is a growing recognition among many countries that we need to change some fundamental things about what our goals are, how we measure progress, and how we arrange our societies in order to better get there.

We're hoping to have a series of workshops in Bhutan to build a better



we're hoping to have a series of workshops in Britain to build a better global consensus on what some of these global measures should be. A lot of where we are today with our economic policies and ideas is based on what happened at the Breton Woods conference that took place in New Hampshire in the post-war 1940s. It's when the World Bank and the IMF were set up. It is also where the GDP was agreed upon as a measure of progress. It was an appropriate vision for the time. As I said, GDP and GPI were highly correlated from about 1950 until 1975. The problem is that we just haven't recognized that we're now in a new era. Our natural and social capital are now the limiting factors, whereas during the post-war period, it was the built capital.

We need to envision a more balanced, more mature economy. With regards to economy, we've been in a period of adolescence. Now we have to level off and stop growing, but continue to develop and improve. No one would like to see his or her body continue to grow indefinitely. You want to stop at some point and say, "OK, now it's time for other things to happen. It's time to improve *quality* rather than quantity." That's where I think the future lies.

**Most of our readers are somehow involved in the practices of ecological restoration, conservation planning and/or regenerative design. Any final words of advice for them?**

We need better, more general definitions of ecosystem health. Conservation planning should take into account biodiversity, ecosystem functioning, *and* ecosystem services - not the least of which are the human health benefits. Basing ecological restoration on returning the system to some prior or more "pristine" state is not really appropriate, realistic, or desirable. Humans have been integral parts of the global ecosystem for over 200,000 years and we need to design a system going forward that allows humans and the rest of nature to both thrive. That will require novel approaches, a new conception of the economy and novel ecosystems. It will require stabilizing human population and a refocusing on quality of life, not just GDP. It will require a better, more integrated understanding of humans embedded in ecological systems. It is the grand challenge for humanity at this juncture. It is easy to be pessimistic, but I am hopeful that we can rise to this challenge and create a better, more sustainable world.

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## Leaf Litter Talks With Randy Hester

For more than 30 years, landscape architect and sociologist Randy Hester has been engaged in process-oriented design that depends on civic involvement and science-based environmental management. He is the co-director, along with his wife Marcia McNally, of the Center for Ecological Democracy in Durham, North Carolina. He is the



Democracy in Durham, North Carolina. He is the author of numerous publications, including the book [Design for Ecological Democracy](#), which occupies a prominent place on the Biohabitats bookshelf.



**You are well-known as an advocate for public participation in the creation of spaces that grow out of an understanding of a community's needs. In your experience, where do human and ecological health generally fall among the needs expressed by a community?**

In the case of city design, I consider the connection between health and environmental process to be indirect. But it is never nonexistent. Even if a community is completely focused on the need for economic development, they are looking for somebody who is going to help them develop a place-appropriate economic strategy. That almost always means that we make an assessment of the constraints and potentials of that landscape, in terms of its watersheds, its capacity to produce its own resources within its own micro-region, etc. The most direct connections [between human health and ecology] come when a community tells us specifically that they want a park or some open space that provides access to nature, because there is a direct link between human health and the environmental process.



For example, in the years that we have worked in Los Angeles to create a greenbelt around the city, people always talked about how they believed they were healthier when they had access to nature. They might not know the literature, and they might not have heard of [Roger Ulrich](#), [Bill Sullivan](#), and [Frances Kuo](#), (researchers who have studied the connection between nature and human health) but they know intuitively that going to Runyon Canon in Hollywood for example, reduces their stress and makes them healthier.

We have worked a lot in California. The ecological process is foremost in people's minds, or at least one of the top considerations. They know there is a connection between ecological processes and human health. I just moved to Durham, North Carolina, and I have been shocked by how much that same dialogue has been going on here. There is something in the local media every day about the relationship between the agricultural production within the region and restaurants, for example. So I think acknowledgement of this connection is much more widespread than I would've imagined.

**In your work, what human health issues come up the most frequently? Are they associated with pollutants in the air or water? Access to recreation or healthy food options?**

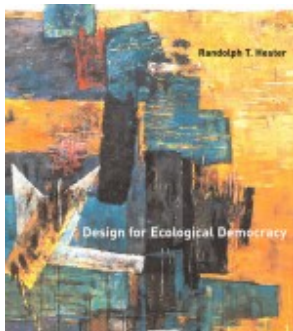
The issue that comes up most often is access to nature. Coming in second would be preserving agricultural land, but that is often more about access to the rural landscape than food supply.

Another health issue that comes up is the desire to reduce the use of the car and make places walkable. Getting rid of pollutants from the automobile and making the pedestrian a higher priority has two direct health benefits. First, it means people are walking more, so obesity and heart-related diseases will hopefully diminish. We'll also suffer less from direct impacts like asthma and the bigger impacts of global warming.



**Not to mention decreased car accidents, I'd assume.**

People might think about accidents, but the more important community health factor is actually how divisive highways are to a sense of community. New Urbanist studies, like those of [Michael Southworth](#), show that putting in a high-speed route becomes a barrier that divides one community from another. Most people aren't going to know that, but when it's brought into the public discussion, it becomes pretty important.



**Your book [Design for Ecological Democracy](#) is a treasured and inspiring resource for the landscape ecologists here at Biohabitats. How do you define "ecological democracy?"**

For people to clearly understand it, we need to look at the present modus operandi of our democracy, which is a very thin democracy. Most of us are supposed to vote occasionally, complain a little bit (but not get very worked up) and consume huge amounts of things we don't really need daily. Then, we're supposed to let corporations buy our government and basically buy out democracy. What we presently have is a pretty non-participatory democracy that is completely controlled by corporations whose interest is not the public interest. Their primary interest is profit making, and in almost every case, it's going to be exploitive of both people and the environment, and it's going to be destructive to the human spirit and to ecosystems. We may think we have the greatest democracy in the world, and it probably works better than it does in other places, but that's the sad state of our present situation. "We the people" are responsible for our government. We have allowed these things to happen. Unless we participate in a much more assertive way...unless our democracy becomes what [author and activist] [Frances Moore Lappé](#) calls a "deep" or "living" democracy...unless we live it and give time to it, it's going to remain the same.

I define ecological democracy as a much more actively participatory government in which environmental and long-term ecological thinking is more dominant than short-term profit. To me, it's a matter of gravest concern. We have this idea that our democracy was given to us by Thomas Jefferson and those guys. but the democracy is only as strong as

the present generation is willing to commit to it. We basically enjoy the pleasures and freedoms that the democracy has given us, but as a people, we are less and less willing to accept the responsibility of governing ourselves.

**How do we do that, and how do we inspire others to participate more actively in this kind of ecological democracy? Is there any place in the world that is doing that well and could serve as a model?**

I'm optimistic. If I weren't optimistic, I wouldn't have written [Design for Ecological Democracy](#). I am not naïve. I have been engaged in big political battles for a long time. I am hopelessly optimistic, but I am not uninformed. I see little moments of ecological democracy happening almost everywhere I go. Unless we can have a constitutional amendment that reduces the powers of corporations (which now have more rights and privileges and less responsibility than any citizen has) It's not going to be a sudden revolution. But these little moments of ecological democracy bubble up all over the place.

Are there some places that are more advanced in this? Certainly, the city of Chicago under the young John Daly was a moment of pretty extraordinary, city-wide ecological democracy. That's the biggest example I know of. But I see it in a lot of neighborhoods. Surprisingly, I see it in Los Angeles. Every once in a while, there might be a mayor, like [Jaime Lerner in Curitiba](#) (Brazil), who is committed to ecological thinking and widespread democratic action.

**What does ecological democracy actually look like?**

In an ecological democracy, a lot of people, particularly at the neighborhood level, participate in planning and thinking about the future of their community. They rise above [NIMBYism](#), and think long-term. They see the bigger, regional issues and try to relate them to their neighborhood.

So what would we see? There'd probably be many fewer people driving. You'd see a lot more green stuff growing—from forests to agricultural products that are consumed in the neighborhood. My guess is that we would see considerably higher density. If we are retrofitting existing neighborhoods, we'd see garages converted to second or third units. It might mean we'd see people living in smaller houses. In new developments, it might be that growth is redirected away from green fields and in towards the central city. People would be smiling a lot more. They wouldn't be moving so fast, and they'd spend more time in nature and less time on the computer.

**In the chapter entitled "Naturalness" in [Design for Ecological Democracy](#), you discuss three beneficial outcomes of experiencing nature: naturopathy, naturism, naturalization. Can you describe these outcomes?**

Naturopathy goes back a really long time. Two centuries ago, there was an assumption that if you built hospitals in a natural environment, there was something in natural processes that was healing. This is where [researchers such as] the Kaplans ([Rachel and Stephen Kaplan](#)), Sullivan,

Ulrich and others have produced undeniable research that tells us that nature heals us and has the restorative power that some people realized a very long time ago.

Naturism is more about encouraging us to act, at least at moments, more like the wild animals we are. Whether it's running naked or simply becoming more aware of our sensual selves, there is clearly something from which we are becoming increasingly detached. As we become more cultured, we become less primitive. That's not necessarily a good thing, and it doesn't necessarily mean that we're going to advance our human selves. In fact, the opposite seems to be true. Sullivan and Kuo did a study that found that people with access to nature were actually more civil to each other. In a [2001] study of the Robert Taylor Homes public housing in Chicago (one section of which was much more wooded than another), they found less domestic violence in the greener area. Nature obviously has benefits that we haven't yet begun to think about. We know for certain that when we're in nature, we are calmed down and our ability to think logically is restored. But it may have other benefits that allow us to think more complexly if we can think like animals in addition to thinking like machines.



The other outcome is naturalization. We need to become "naturalized." We need to reapply for our citizenship in nature. This really comes from [David Orr's](#) work in ecological literacy. We're pretty stupid about the environments in which we live. Part of that comes from moving around so much, and part of it comes from parental fears about nature. If we move with such

frequency that we can't learn about our place, we're in trouble.

Those are the benefits of nature. We have overwhelming evidence about some of them. Others will be the subject of research that will take place over the next five, 10 or 20 years. Researchers are making the connections between the ecosystems in which we live and human health. This research is probably more important for the whole human species than the genetic engineering stuff that is going on (which will also save and prolong lives).

**In the thinking and science behind these outcomes, do people distinguish between "green space" and a space with healthy, functioning ecosystems?**

That's so key. Most people have an aesthetic bias against many of the most important ecosystems. Most people think of wetlands as stinky, mosquito infested swamps rather than the nursery for so many of the fish that we eat. We have an aesthetic bias for the savannah landscape and for prospect refuges, but our gut response to a swamp is no different than our visceral response to seeing, say, a copperhead moccasin. That means that we have to learn by experience how beautiful something like a rainforest (as opposed to a "jungle") or a wetland (as opposed to a "swamp") is. We gain that information by experience and by learning ecological principles.



**When you are designing a city, park or community, what do**



**you perceive to be the greatest challenge to ensuring these benefits of nature?**

The single greatest force is real estate economics. We continue to think of the highest and best use of any piece of property is some form of development. We don't just need natural areas for aesthetic pleasure; we need them for flood protection, clean air, etc. Clearly, land has an extraordinary value, for those ecological functions, that is completely counter to real estate profits. That's the biggest challenge.

**Despite this challenge, you have been able to successfully integrate nature into urban design. The Natural Park project in South Central Los Angeles is a great example. Tell us about the project.**

Years ago, the Bloods and Crips, two of the most infamous gangs in South Central L.A. actually developed their own plan for the rehabilitation of Watts and their Central City neighborhoods. One of the things they were in agreement on was the greening of their neighborhoods. Here were these notorious street gangs that we associate with everything illegal and terrifying, and they were asking for the same thing that other people want. The city councilwoman in South Central [Rita Walters] also wanted to have parks that weren't just basketball courts and paved recreation facilities. She wanted to bring nature to South Central L.A. We worked with her and with the Santa Monica Mountains Conservancy to find a site that we could develop. What we found was an nine-acre industrial wasteland at the corner of Slauson and Compton, and that became a nature park.

The design did not include any developed recreation. There are no basketball courts. It's the ecosystem that we could create in a tiny, tiny space. It has an arroyo. It has hills that are 25 to 35 feet high so it has microclimates of vegetations. It can go from the walnut and oak landscape to the coastal sage scrub. It's a pretty rich microcosm, and there are places in this nine acres where you *can* be slightly disoriented. When you observe kids playing there now, that capacity to explore and have real, natural adventures is there, and it's pretty amazing.



*Photo by Marcia McNally*

It was really interesting working with people in the neighborhood. When they talked about what was important, they clearly wanted a place where they could get away and feel like they were almost lost in nature, but it couldn't be too scary. We learned, through an extensive, participatory process, that citizens' first priority was to have more police protection at the park. The second was to have a full-time park ranger who lived in the neighborhood. So, the nature center has an attached apartment, and a full-time ranger lives there. That person is less of an enforcer and more of a mentor.

The park also has lots of educational programs. Kids can learn how to grow their own food. They even have campouts in the park. For many kids, it's the first time they've ever slept out in a tent. The place has really been well managed, well cared for and well respected. The gangs do not fight there.

Many people have written about this project and interviewed former gang members, park staff, and others in the community. The park became a place where parents knew their kids would be safe.

**I read that in your efforts to solicit community input for this project, public meetings proved ineffective and that you had much more success when you got out in the neighborhood and went into places that people frequented. Tell us about that.**

I think of myself as being an expert in participation. There's nothing I don't know about it, right? Well, with every project, I end up being the kindergarten baby.

We know that public hearings are not very good, so we tried workshops and charrettes. They certainly are better, and people build social capital with those kinds of techniques. But in many communities, people just don't primarily go to advertised, publicly sponsored community events. We have to go to where they are-especially with people who haven't ever participated in grassroots democracy. We can't simply say the process has been democratic because we advertised it and everyone had an equal opportunity to come.

When we were working on the Natural Park, there was a supermarket at the corner of Slauson and Compton. One of my students had the insight (it wasn't my insight!) that since everybody we were trying to talk to was going to the supermercato, we should set up a table and solicit people's opinions there. That's what we did, and we got hundreds of people to participate who otherwise would never have initially participated. We got great feedback from people at the supermarket, and then some of those people started coming to the more formal meetings and workshops and became major participants. People clearly enjoyed coming to the workshops *after* we made this initial contact.

We have to figure out where to engage the people who are historically left out. This makes me think of another project in L.A.'s Runyon Canyon. People were really afraid of that canyon because there were homeless people living there. I sought out every homeless person we could identify, and we did an interview with each one of them. That became part of the community record. It was really useful because about a third of the people we interviewed said they would have been happy to go to a shelter, but there wasn't one close by. A third of the people were not, under any circumstances, going to go to a shelter, and were in need of much more extensive help. And about a third of them were pretty well-functioning, and we found places in the park where they could continue to live without bothering other people. Knowing that was really important.

We frequently do not engage marginal people, and they are going to be primary users of all public open space. We need to find out what their needs are and accommodate them as best we can. In the case of Runyon Canyon, Richard Riordan (who later became Mayor of Los Angeles) who was then head of the Parks and Recreation Board, raised the money to build a homeless shelter that would serve people near Runyon Canyon. He actually responded to this need and served the public.

**You write about the importance of "sacred structure" to design.**

## **What exactly do you mean, and is there a connection between the sacred structure of a place and the health of its ecology and people?**

This is the most important lesson that we learned in a project in Manteo, North Carolina [revitalization of the town's central waterfront ]. This was a place where people were fiercely opposed to any coastal zone management legislation. Local people everywhere along the rural coast of the North Carolina were absolutely opposed to any regulation that would protect these environmental resources.

We decided [as part of the design process] map the places local people really valued. We had to get at that information by sociological measuring that was not necessarily direct. We interviewed people about the places that they felt made up their small town, rural character. We observed what people did and noted the patterns. We did a newspaper survey that ranked places of importance to preserve-places people thought were so important that if you destroyed or changed them, it would diminish their community life. Over two dozen of these places ranked higher than the schools and churches. We made a map of these places, and when one city councilman looked at it, he said, "That's the sacred structure of Manteo." Since then, we've always called places the community holds most dear "sacred places." Usually they are subconsciously held dear and we have to help the community articulate them or they just never become part of the planning process.



*Image courtesy of  
Community  
Development by Design*



Here's where it gets interesting. Among the top ten most important places [identified by citizens of Manteo] were the wetlands that surround the town. This was a community that had violently opposed legislation to protect wetlands! I believe the wetlands in Manteo were important because they defined the edge of the community. Having a natural boundary has proven to be one of the most important parts of the sacred structure everywhere we've done this, in dozens of communities.

Suddenly, it became clear that the opposition to preserving wetlands was less about the wetland itself and more about federal intervention. It led me to the conclusion that identifying the sacred structure, in almost every case, would elevate some fundamental ecological process to the level that the community would want to protect it by local legislation, even though they might oppose the same protective measures if they were being imposed on them. We have found this to be true everywhere-in

Haleiwa, Hawaii, Los Angeles, Taiwan, and Japan.

## **How does a community's sacred structure contribute to the health of its people?**

Here is what I think (this is me interpreting what many of my colleagues have researched and written about for years): for healthy human development, we have to have a sense of center in the place where we grow up and live, some kind of natural boundary, and some sense of what is ecologically, physically, sensually unique about the place where we grow up. If we don't have those things, we are not going to form strong attachments to place, and therefore we will not take care of the place. We also won't be nurtured by the place. There is literature that supports the "subpieces" of what I just said, biophilia and topophilia support this. But I believe now that for healthy human development, having center and natural boundaries is the most important long-term health consideration. It's more about psychological health, but without any question on my part, it's about health.

**Most of our readers are involved in restoring and improving ecosystems, so they're very familiar with the concept of environmental stewardship and regard it as a good thing. But as you point out in your book, it's complicated. Talk about "reciprocal stewardship."**

When we go out to do a wetland restoration, or replant a detention basin with wetland plants to clean stormwater, we are doing something that seems good for the environment, but the benefits we receive are huge. It helps us overcome "ecoparalysis." Problems can be so monstrous that we sometimes wonder what we can do. Doing something that makes the environment better gives us a sense of empowerment that we *can* make a difference. We may, for example, be able to prevent extinctions. It's also usually good exercise, and we make friends with people we might not have otherwise met.

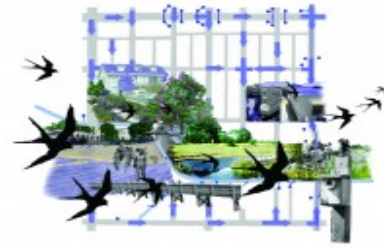
For me, when I take care of a piece of land, I can feel it reciprocating and taking care of me. I not only can feel the plants giving me the oxygen I need, but I can feel them sort of wrapping their vegetative arms around me and nurturing me. By healing the earth, we heal ourselves. I'm sure every single *Leaf Litter* reader already knows and feels that.



The interesting thing to me is to think about reciprocal geometries between, for example, ecotourism and the creation of bird habitat. We need to think about mutually beneficial, symbiotic relationships that we can actually create that we haven't thought about before. The most obvious is that if we increase density of housing, we can save more wildlife habitat close in to where we live. That is an example of this intellectual reciprocal stewardship.

To me, this is the most interesting next frontier-making the city have reciprocal and recombinant geometries that are benefitting both the ecological system and the human system. Sometimes it's not just about our health. There might also be an economic benefit. Low impact design stormwater management is a really good example. We're clear that if we retrofit stormwater management systems, they'll be less expensive to the public sector in the long run. They obviously provide health benefits and transparent ecology. We think we're doing them just for cleaning stormwater, but they have dozens of other benefits.

My wife, and partner in our firm, Marcia McNally, did a plan for the Los Angeles River which showed which bird species you could actually accommodate in each one of these (in some cases tiny) tiny stormwater basins. You could go from a Red-wing Blackbird, which will live almost anywhere there are cattails, to a species like the Sandhill Crane, for which the whole Los Angeles region would have to be reconfigured to attract again. It gives us a way to think about new geometries for the city.



*Image courtesy of Community Development by Design*

**How do we as engineers, designers, or even communicators inspire this kind of stewardship beyond the walls of our firms and project partners to the greater public?**

We have to engage people who are different than us. It's not so easy to engage the homeless, new immigrants, or people from the religious right. But it's these other publics that we have to consciously go out of our way to engage-in every project. Sometimes, we have to ask, "Who are the people who are least likely to have an interest in this project?" and then find a way that they will have some interest. We have to see our work as a long-term agenda. We have to get more people engaged in stewardship.

Here is the upside to all of this. Ecology is not very enchanting, but nature is enchanting. If kids get involved in creating firefly habitat, or catching tadpoles, it's irresistible. It's also irresistible to parents. We always have to remind ourselves that people may not be concerned about ecological process as much as they are just completely enchanted by the spell of nature.

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**Environmental Justice:**

**Linking Public And Environmental Health**

**By Jennifer Dowdell, with Nicole Stern and Amelia Greiner**

It would be negligent to address the links between ecological health and human well-being without mentioning environmental justice. Environmental justice is defined as the equal distribution of environmental benefits and harms, and the meaningful involvement of all peoples, regardless of race, income or socio-economic status in the development, implementation, and enforcement of environmental laws, regulations, and politics.

The birth of the environmental justice movement is





often attributed to the widely reported outcry over the placement of a toxic waste landfill in a poor, minority community in Warren County, NC in 1982.



In the years that followed, two key documents helped to define the issue and shape the path forward: *Toxic Waste and Race in the United States* was published in 1987 and the *Principles of Environmental Justice* were adopted in 1991.

At their core, environmental injustices tend to be the results of poverty and its attendant problems: few resources to address health issues, lack of political engagement or clout, scientific illiteracy, and poorly organized communities. Addressing environmental justice concerns helps to minimize and prevent vulnerable populations from being disproportionately burdened by environmental hazards, pollution, and their localized health effects. In his book, *Ecological Democracy*, renowned landscape architect and sociologist [Randy Hester](#) explains that "as citizens participate in the day-to-day aspects of city design subtle questions of equity arise: Who has information? Who does and does not understand and have access to local government agencies? Who typically participates in the design process and who doesn't? Who lacks power to influence decisions that affect locality?"

In 1994, President Bill Clinton signed an Executive Order that focused federal attention on the environmental and human health conditions of minority and low-income populations. The Order directed federal agencies to develop environmental justice strategies to help address disproportionately high human health or environmental effects of agency programs on minority and low-income populations.



As evidenced by the *Toxic Waste and Race at Twenty: 1987-2007* report, environmental justice problems are far from resolved. In the wake of Hurricane Katrina, disparities became apparent in communities across the Gulf Coast. At-risk communities located near waste disposal sites, oil refineries, failing levees, and in extremely

low-lying areas were affected in huge numbers, shining light on a history of injustices.

In recent years, efforts have expanded to include sustainability and climate change concerns, the management of wilderness and wetland areas, environmental issues in indoor living environments, urban habitats, and Native American reservations. Such efforts help to reframe and refine the problems, offering opportunities to advance environmental literacy, and recognize the scale of the issue and the potential need for additional efforts to address the harm. With environmental justice comes healthier neighborhoods and healthier ecosystems, which in turn benefit the

broader community.

References and more resources and information about environmental justice can be found in the [Resources](#) section of *Leaf Litter*.

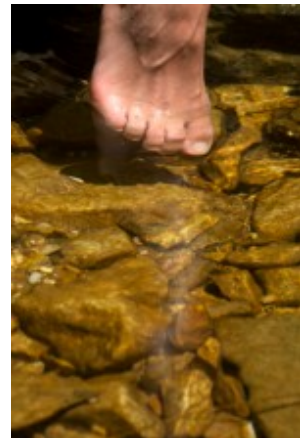
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## Water Quality & Public Health

By Nicole Stern

Do you think about the hydrologic cycle in your watershed when you turn on the tap or dangle your toe in a stream? If not, you should. Every upstream use of that water could affect your health.

Pollutants found in our finite stash of fresh water around the globe come from a variety of sources, from sewage to industry to household chemicals. Under the Clean Water Act, the U.S. Environmental Protection Agency (EPA) regulates pollutants in streams and other waterbodies by setting 'pollutant diets' called Total Maximum Daily Loads (TMDLs) based on the monitoring of impaired waters. While some of the categories of regulated pollutants impact non-human species more directly (e.g., nutrients such as nitrogen and phosphorus may lead to streams unsuitable for fish,), the regulated



categories of pollutants which relate most directly to our own health include pathogens, metals, and chemicals.



The most immediate tie between water quality and public health is bacteria in waterbodies. In a [recent story on NPR](#), Carol Nemeroff, a contagion psychologist from University of Southern Maine, pointed out that, " . . . there is no water that has not been pooped in somewhere" (Spiegel 2011). Fecal coliform bacteria is a standard measure

of water quality but is actually only an indicator of some source of feces, and therefore potential for a variety of pathogens in the water. Sources for bacteria are typically categorized as human, domestic animal, agriculture, or wildlife. Human sources of fecal coliform bacteria are often a sign of improperly treated wastewater, leaking sewer infrastructure, or the result of combined sanitary and storm sewer overflows (CSOs). Contagions are a major concern in waterbodies that are used for recreation where the bacteria count is high.

Toxics including various chemicals, mercury and other heavy metals found in waterbodies are another tie between water quality and public health. The EPA [Toxics Release Inventory \(TRI\)](#) database reports the release of toxic industrial and commercial chemicals. The TRI includes over 600

different toxic chemicals from thousands of facilities in the U.S. Household chemicals such as pesticides may also contribute to toxics in watersheds. These chemicals and metals often settle in sediment at the bottom of streams and other waterbodies or can collect in fish tissue. EPA TMDLs list impairments by watershed and waterbody [on their website](#). For example, some waterbodies in Baltimore County, Maryland have TMDL regulations for mercury, chlordane, and PCBs. These toxic sediments can become a public health issue if citizens come in contact with the bottom soils in streams and waterbodies or if they consume fish from these waterbodies. Check the [EPA web site for more information on fish consumption advisories](#).

Perhaps the least understood pollutants found in water are the result of pharmaceuticals that are often not filtered through conventional wastewater treatment. These include pain killers, birth control hormones, and antibiotics, which are not only flushed down toilets as pills, but are also in human and animal waste.

While we may understand the effect of these drugs on our bodies in the short term, we definitely do not understand the impact they could have on our aquatic ecosystems and long-term consumption as part of our water supply if they are not broken down through treatment processes. Recent studies have already shown impacts to wildlife, such as



[male fish showing female characteristics](#).

The good news is that we can filter many pollutants out of water using ecological processes such as stream restoration, stormwater management, and constructed wetlands for wastewater treatment. By aerating water we can remove a high percentage of bacteria and pathogens from the water. Some plant species will uptake heavy metals into their leaves which can be burned and reclaimed from the soil.



What can you do? Supporting regulations for industrial and commercial pollutants may prevent further toxics from entering our waterways. Being conscious of your use of household chemicals, fertilizers, and the disposal of pet waste can also play a role. Becoming active in your local watershed or [Waterkeeper](#) organization can be a great way to learn more about your local waterways. Participating in local volunteer activities to monitor and clean your streams, rivers and other waterways can be a fun way to connect with these organizations and contribute to ongoing efforts to improve watershed and public health.

Of course, the best way to deal with pollutants in water is to prevent

them entering the watershed in the first place. Biohabitats is honored to be involved with one community that is making progress in that regard. After signing a joint agreement to protect and improve their shared watersheds, Baltimore City and Baltimore County, Maryland put together a plan of action toward that goal. As part of this plan, the City and County will convene a roundtable discussion involving public health and water quality experts next month to discuss what research has been done, what still needs to be done, and how best to remedy the issue of bacteria in Baltimore's watersheds.

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## Resources

In addition to the publications and links that appear elsewhere this issue of *Leaf Litter*, we present the following resources related to the connection between ecological and human health.

[Books by Sandra Steingraber](#)

[Books by Robert Costanza](#)

[Recent presentations by Robert Costanza](#)

Books by Randy Hester

<http://www.ced.berkeley.edu/ced/people/query.php?id=56&dept=all&title=all>

[Environmental Health News](#)

[Environmental Working Group](#)

[The Endocrine Disruption Exchange](#)

[Food and Water Watch](#)

[Health and Environment Alliance](#)

[International Chemical Secretariat](#)

[Journal of Environmental Psychology](#)

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[National Pollution Release Inventory](#) (Canada)

[Pesticide Action Network](#)

[Science & Environmental Health Network](#)

[Silent Spring Institute](#)

[Solutions Journal](#)

[Toxipedia](#)

[U.S. EPA's Toxic Release Inventory](#)

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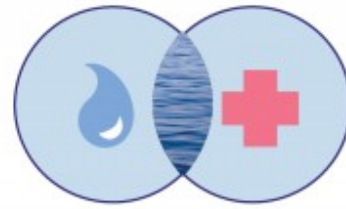
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## **Biohabitats' Projects, Places and People**

### **PROJECTS**

## Health & Water Quality: Powerful Dialogue To Begin

As Nicole Stern mentioned in her article on [Water Quality & Public Health](#), Baltimore area health researchers, water quality experts, community NGOs and representatives from municipal government will soon come together to share data and expertise. We are very excited to help coordinate this public health roundtable, which is intended to spark dialogue about the intersection of public health and water quality, specifically focused on bacteria. This type of enhanced collaboration among disciplines is expected to result in a more informed and coordinated effort to form policy that will improve the health of the water and people of the Baltimore region.



## Planned Greenway Aims To Improve Ecology and Public Health

In spite of its rich cultural history and intriguing natural features, Southwest Louisville currently lacks an easy way for people to access and interact with the natural environment in a way that does not depend on the automobile. The goal of the [Southwest Greenways Project](#) is to encourage people to improve their fitness and health and make them more aware of the region's resources by creating a system of greenways. As part of a multidisciplinary team, Biohabitats is providing the ecological basis for the planning and design of the greenway system. Our work includes engaging the community in the development of trail alternatives, researching existing ecological studies, identifying and filling critical data gaps, and helping develop greenway alternatives that not only protect existing ecological communities but also restore degraded areas to their full ecological potential.

## Gonna Be Some Happy Fish In South Boulder Creek!



Before/After: a completed portion of the restoration.

South Boulder Creek has long delivered ecological and recreational benefits for the City of Boulder. Now that final construction is underway on the restoration of two miles of the creek, it's about to bring even more. Biohabitats led this design/build project for the City's Open Space and Mountain Parks Department, supporting their efforts to improve aquatic habitat along a portion of the creek that had suffered the impacts of water diversions, channel modifications, and grazing. To accommodate the channel's varying morphologic conditions, the restoration

incorporated a diverse suite of solutions and eight different design elements. These included boulder clusters, a low flow meander channel, side nooks, log cross vanes, stem/nooks, log wind deflectors, and woody

side pools, log cross fences, step pools, log wing connectors, and woody debris clumps. The Colorado Division of Wildlife, which awarded a 'Fishing is Fun' grant to help fund the project, will stock the project area with a Whirling Disease-resistant rainbow trout (Hofer-strain) to try to establish a self-sustaining population for recreational fishing.



*Image courtesy of Rios Clemente Hale Studio (RCHS)*

## **Stormwater Justice To Be Served At Federal Court House**

Stormwater from the parking lot and one-acre rooftop of the Pete V. Domenici U.S. Courthouse in downtown Albuquerque receives no on-site treatment. It gets pumped into the City's storm sewer and put on a fast track directly to the Rio Grande. But all that is about to change. Biohabitats subsidiary NSI is playing a major role in a collaborative design effort to vastly reduce the site's water use. The project, led by Rios Clemente Hale Studio, involves shifting the landscaping from turf grass to native, xeric planting, harvesting rainwater from the rooftop, and diverting stormwater into depressed planting beds, where it is filtered through bioretention and an underground vortex separator. The federal government recently approved the project, and it is moving forward into bidding.

## **Community Puts Finishing Touches on Washington, DC Stream Restoration**

Community volunteers spent a beautiful Saturday planting native trees and shrubs and installing deer protection cages along Milkhouse Run, located in the region's popular Rock Creek Park. This Biohabitats and Underwood Associates design/build project for the District of Columbia

Department of the Environment was funded through the American Recovery and Reinvestment Act. The design employed a regenerative stormwater conveyance approach to restore more than 1,000 linear feet of severely degraded channel and reconnect it with its floodplain. Project partners and supporters from the National Park Service and the Rock Creek Conservancy helped organize the volunteer event, which resulted with lots of happy, sweaty, dirty kids and adults improving and learning about their local, urban ecology.



## **Brownfield Site Transforming Into Model For Sustainable Development**

Though the Buffalo River suffered neglect and abandonment throughout Buffalo's industrial growth, it is now poised for a dramatic comeback. The Buffalo Urban Development Corporation's RiverBend development.





Leadership and Research sessions at [Greenbuild 2011](#) in Toronto.

Water resources engineer John Hathaway from our Southeast Bioregion office will present "Stormwater Treatment for Bacteria" at the [Smart Growth and Sustainable Site Design Conference 2011](#), which will take place October 12-13 in Columbia, SC

On October 11-12, Biohabitats Great Lakes Bioregion leader Ivette Bolender will be in Detroit for the [2011 Annual Meeting of the Great Lakes Commission](#). Ivette will be joined in Detroit by senior environmental scientist Paul Kovalcik for the [7th Annual Great Lakes Restoration Conference](#) October 12-14. We're delighted to be jointly sponsoring this conference with some of the members of Biohabitats' GLRI Team: Planning Resources Inc., Short Elliott Hendrickson, EA, ASC Group, Environ, CEC and Stantec. Be sure to stop by our booth and learn about some of the work our team has already begun on GLRI-funded projects!

Biohabitats president Keith Bowers and associate engineer Erin English will join Ben Haggard of [Regenesis](#) in presenting "Regenerative Design: "Story of Place" and a Collective Water Future for the Bay Area" at the [Bioneers Conference](#) in Marin, CA October 14-15.

On October 14-16, senior engineer Pete Munoz will present "Reaching Toward Regenerative Design" at the [annual gathering of the Great Lakes chapter of Bioneers](#). Pete will discuss how using water as a cornerstone of design can produce movement beyond the "demonstration" phase of sustainable infrastructure and design.

Senior ecologist Joe Berg and water resources engineer Ted Brown will attend the [Maryland Association of Floodplain Managers Annual Meeting](#) on October 20 in Timonium, Maryland.

Senior engineer Pete Munoz will be in Portland, OR on September 26 attending [Ecodistrict Summit 2011](#).

October 26-27, Ivette Bolender and Paul Kovalcik from our Great Lakes Bioregion office will attend the [State of the Lakes Ecosystem Conference](#) in Erie, PA.

Biohabitats president Keith Bowers, ecological landscape designer Nicole Stern and associate engineer Erin English are all on the agenda for this year's [annual meeting of the American Society for Landscape Architects](#) in San Diego October 30-November 1. Nicole and Erin are giving a presentation on floating wetlands and Keith will co-present "Climate Change: What Landscape Architects Should Know."

On November 2-4, project engineer Alan Garrido will head to his hometown university in Neiva, Columbia to attend II Seminario de Uso Racional del Agua en Proyectos de Irrigacion y Acueducto.

From November 7-10, water resources engineer Jennifer Zielinski and senior engineer Pete Munoz will be attending the [AWRA's Annual Water Resource Conference](#) in Albuquerque, NM. Pete is presenting "Redesigning the Urban Neighborhood" and Jennifer is co-presenting **"Green Infrastructure and Brownfield Redevelopment at RiverBend, Buffalo, New York."**

**On November 15, natural resources ecologist Mike Thompson will attend the Chesapeake Water Environment Association's conference on [Wet Weather Issues: Piped and Un-Piped](#) in Linthicum, MD.**

Senior fluvial geomorphologist Ellen McClure will present "**Creative Design: The Handmaiden of Restoring Hydrologic Connectivity and Ecological Function**" at the [Mid-Atlantic Stream Restoration Conference](#). The conference takes place November 15-17 in Flintstone, MD.

## PEOPLE

We are extremely pleased to announce that the American Society of Landscape Architects (ASLA) elevated Biohabitats president Keith Bowers to its [2011 Council of Fellows](#). Keith joins only 39 other landscape architecture professionals in the nation this year in the fellowship, which is among the highest honors the ASLA bestows on members. This designation recognizes Keith's contributions to his profession and the society at large based on his leadership and management, and his exceptional accomplishments over a sustained period of time. We couldn't be prouder of our leader! Kudos, Keith.

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## Glossary

**Anhydrous Ammonia:** a colorless, highly irritating gas with a sharp, suffocating odor. (North Dakota Department of Public Health)

**Dioxin:** a group of more than 200 chemicals with a similar structure but varying levels of toxicity, including polychlorinated biphenyls (PCBs), polychlorinated dibenzo dioxins (PCDDs), and polychlorinated dibenzo furans (PCDFs). (BBC Health)

**Gross Domestic Product (GDP):** one the primary indicators used to gauge the health of a country's economy. It represents the total dollar value of all goods and services produced over a specific time period. (Investopedia)

**Genuine Progress Indicator (GPI):** an attempt to measure whether a country's growth, increased production of goods, and expanding services have actually resulted in the improvement of the welfare (Wikipedia)

**Fracking:** Hydraulic fracturing; the process of initiating, and subsequently propagating a fracture in a rock layer, employing the pressure of a fluid as the source of energy. (Wikipedia)

**Precautionary Principle:** states that if an action or policy has a suspected risk of causing harm to the public or the environment, in the absence of scientific consensus that the action or policy is harmful, the burden of proof that it is *not* harmful falls on those taking the action. In some legal systems, as in the law of the European Union, the application

of the precautionary principle has been made a statutory requirement.  
(Wikipedia)

**Social Capital:** all of the interactions among people, through formal and informal networks and institutions. (Source: Robert Costanza)

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## About Leaf Litter

**Leaf Litter** is a publication of Biohabitats, Inc. Coinciding with the earth's biorhythms, it is published at the Fall Equinox, Winter Solstice, Spring Equinox and Summer Solstice to probe issues relating to conservation planning, ecological restoration, and regenerative design. Biohabitats has attempted to ensure the accuracy and veracity of the information provided in *Leaf Litter*, however, information contained in *Leaf Litter* should not be construed as a recommendation or endorsement by Biohabitats. Please click [here](#) to contact Leaf Litter editors with questions, comments or content ideas.

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**Chesapeake/Delaware  
Bay Bioregion**  
Baltimore, MD  
(410) 554-0156

**Great Lakes Bioregion**  
Cleveland, OH  
(216) 921-4430

**Ohio River Bioregion**  
Louisville, KY  
(502) 561-9300

**Southeast Bioregion**  
Raleigh, NC  
(919) 518-0311

**Southern Rocky  
Mountain Bioregion**  
Denver, CO  
(303) 477-0660

**Hudson River  
Bioregion**  
Glen Ridge, NJ  
(973) 748-9800

North Charleston, SC  
(843) 529-3235

**Natural Systems  
International**  
Santa Fe, NM  
(505) 988-7453

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