

The Thought Leader Interview: Gretchen Daily by Art Kleiner

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by Art Kleiner

Photograph by Vern Evans

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A leading proponent of natural capital valuation says we can build long-term prosperity by assigning prices to the ecosystems next door.

The decline of ecological diversity is often seen as an environmental issue, but it's also a business problem. Consider the case of Hawaii, where more than half of the bird species and a significant number of plant species have become extinct or endangered during the last 100 years. Among the endangered trees is the koa, a hardwood prized for its hue and grain, which has receded as cattle ranching has expanded. A healthy koa forest has value beyond the furniture and flooring harvested from it. It draws moisture out of the air, replenishing groundwater. It can help limit the spread of fires, flooding, and reef-smothering sediments. It provides a carbon sink, a natural absorber of greenhouse gases from the atmosphere. The koa can also serve as an anchor species: If more lush koa forests were restored, other endangered species would return to those habitats, including indigenous birds (*`akiapola`au*, *`i`iwi*, and *`oma`o*) that spread seeds and pollen and thus enable further ecosystem growth. Moreover, trees like the koa represent a major part of Hawaii's natural beauty and culture, on which its distinctive tourism and

Art Kleiner*kleiner_art@**strategy-business.com*

is editor-in-chief of *strategy+business* and the author of *The Age of Heretics* (2nd ed., Jossey-Bass, 2008).

recreation industries depend.

When all these current and potential benefits are factored in, it could be argued that the original native forest would be of far more business value than a landscape dominated by cattle ranches, which are vulnerable to the price of their single agricultural commodity. But many ecosystem benefits are traditionally seen as externalities; businesses don't directly pay the hidden costs of a destroyed forest. And whereas ranching pays off only in more immediate and tangible ways, the value of a natural ecosystem pays off over the long term. How, then, can a business community come to realize its value?

Answering that question is at the center of Gretchen Daily's work. At Stanford University, she is the Bing Professor in Environmental Science in the department of biology, a senior fellow at the Woods Institute for the Environment, and director of the Center for Conservation Biology. She is also known for her book *The New Economy of Nature: The Quest to Make Conservation Profitable*, coauthored with journalist Katherine Ellison (Island Press, 2002). In 2006, she cofounded the Natural Capital Project, a

joint venture between Stanford and the two largest conservation organizations in the world, the Nature Conservancy and World Wildlife Fund. The project's purpose is to develop methods for measuring the economic value of natural ecosystems, and to integrate this value into the decisions of communities, governments, and businesses.

This endeavor has cast Daily in the role of a Jane Appleseed of ecosystem protection and renewal. She works with groups in China, Costa Rica, the U.S., and Europe to develop forms of land use that enhance both environmental quality and sustained economic growth. In Costa Rica, for example, Daily led a group that discovered that coffee plants located near fully diverse rain forests were 20 percent more productive, and yielded higher-quality beans, than plants farther away. As reported in the *Proceedings of the National Academy of Sciences*, this was a direct result of pollination by the rain forests' indigenous bees — whose services increased by US\$60,000 the annual income to a single farm, without the farmer knowing it.

Daily sat down with *strategy+business* in July after her panel pre-

sentation (with biologist David Tilman) at the 2009 Aspen Ideas Festival, an annual event held by the Aspen Institute in Colorado. We followed up by phone in August so that she could comment on more recent developments in China and elsewhere. The decline of species and ecosystems is a grave and underreported issue with enormous economic consequences; businesspeople, however, may be equally interested in the broader challenge of externalities. How can we put a price on resources we share, such as goodwill, common knowledge, and the environment — resources over which we have only partial control, for which we have incomplete accountability, and yet which we cannot take for granted? Gretchen Daily's work (and that of her many colleagues) begins to show a path out of this thicket.

S+B: In your panel presentation, you said that it's a new idea to regard an ecosystem as a valuable asset. What did you mean?

DAILY: Since the dawn of humanity, people have been a small-time force on the planet. Except for matters of local scarcity, nature's life support systems were free and abundant. We

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never had to think about the dangers of running out of fertile soil, clean water, or pollinators (such as bees, birds, and bats) that made it possible to reap a harvest; an ozone layer to shield us from ultraviolet radiation; or forests to soak up precipitation and control flooding. Before the late 20th century, anyone living in Louisiana could take for granted that the barrier islands off the coast would help protect them from storms.

Today, that has changed. Shoreline ecosystems have been so eroded by development that many communities were more vulnerable to Hurricane Katrina in 2005, and to the Indian Ocean tsunami of 2004. The world's population is close to 7 billion now, and many people in emerging countries hope to live like the Americans they see on television shows. They're going to demand more protein, such as beef or chicken, in their diets, which will require a sixfold increase in the amount of grain consumed per capita. That would require much more arable land than we have on the planet, even if we cut down all the remaining natural forests. And if we did do that, the increase in greenhouse gases would make the risks of cli-

mate change far worse.

In other words, humanity is rapidly liquidating its own long-term life support systems. And we've only just begun to pay the price. Anywhere you look, there is suddenly a zero-sum game when it comes to land, water, or other key natural resources. We can't afford to go on treating nature like an all-you-can-eat buffet. We need to recognize that there are a ton of people sitting around this one little table, and we've got to establish both prices and table manners to sustain the bounty.

S+B: How do you establish a price for an ecosystem?

DAILY: The first step is to appreciate that ecosystems are valuable capital assets that, when properly managed, sustain a flow of vital benefits over time. These benefits vary from place to place. But their value can be quantified — both in biophysical terms, such as how much groundwater is recharged or how clean the water is, and in economic terms, for example, what it would cost to manufacture a substitute for that free service we get from nature. We need to recognize, and put a price on, the value of the natural land and

water around us, as we do for physical, financial, or human capital.

The next step is to get practical and set priorities about which ecological benefits are most critical. Which are at greatest risk of depletion, for which there are no substitutes at the scale required? Which merit new investments? Where will the return on investment be highest for either a private corporation or a government?

Scarcity will drive many of these decisions. For example, air quality is still relatively high in most places, so there is less incentive to curb air pollution. Other aspects of natural capital, like protection against disasters and reduction in greenhouse gases, have more value right now. In many parts of the world, fresh drinkable water has become the scarce resource most likely to determine economic growth and well-being. Wars will be fought over water supply.

Unintentional Moonscapes

S+B: What kind of scarcity are we actually talking about?

DAILY: I sometimes use the analogy of going to the moon. Suppose you were building a colony there.

What ecological assets would you need to bring with you to sustain human life?

Earth is obviously not a sterile place. But it's in the midst of a mass extinction. If we keep going at current rates, we're expected to lose 50 percent or more of the plants and animals that exist now by the year 2100, mostly from wiping out their home ecosystems, such as forests and wetlands. This will rapidly transform huge areas of the planet into systems that are very reduced in their capacity to generate vital life support services for society. The affected areas will include not just cities and suburbs, but areas of intensive agriculture and grazing; from a species and ecosystem perspective, they will be more and more like moonscapes.

S+B: What kinds of life would you bring back to these “moonscapes”?

DAILY: There are four priorities. The first is the plants and animals that provide goods that people consume directly. This in itself is an extensive list. It includes food, timber, fiber, and medicinal plants — the natural precursors to our pharmaceutical products. Of the top 150 prescription drugs on the market in the industrialized world, about 120 owe their origin to natural products, mostly to plants.

The second priority includes life support services, living things that help protect people from risk. Flood control, water purification, pollination of diverse plants, generation of the ozone layer, renewal of soil, and the use of forests to draw carbon from the atmosphere fall into this category, as does disease control. In the northeast United States, the risk of Lyme disease is higher where forests have been cut

back to tiny patches, where there are fewer mammals like chipmunks, squirrels, foxes, weasels, and coyotes — wildlife that would have kept down the population of mice or deer, which are now likely to infect more ticks with Lyme bacteria.

The third priority encompasses the many cultural values that make living feel worthwhile: the inspiration that people draw from nature, the spiritual attachment many people have to natural places, the aesthetic beauty, and the recreation that people look for in nature.

S+B: And the fourth?

DAILY: It's what economists call option value. That is the value of protecting something for possible benefits to be discovered in the future. We don't know how many types of plants and animals are needed to sustain human well-being, or which combinations. Each year we discover new uses and values associated with nature.

But merely assigning economic value to these four categories will do nothing to ensure the protection of natural systems — unless people are required to factor their value into decisions. And that's where table manners come in. The name of the game today is to change policy: to develop incentives and prices and new public and private finance mechanisms so that people will behave in ways that reflect the real worth of these ecosystems.

Costa Rica and China

S+B: This sounds like the “environmental economics” movement of the late 1980s. Ecologists have been trying for years to assign values to nature and charge the costs back to those who pollute or exploit land.

What's different now?

DAILY: It's true; in fact, you can trace these ideas back to the 1950s, to classic economic work on the problems of open-access fisheries. You can actually trace some of these ideas back to Plato. But just in the last few years, the threats to ecosystems have grown more dire — and there's also been a real renaissance of innovation. In many countries, people are for the first time looking beyond that first category of ecosystem goods to the steep declines in life support services, and they're taking action.

S+B: For example?

DAILY: The two most prominent examples are Costa Rica and China.

The Costa Rican story goes back to the late 1980s, when this Central American country had the highest deforestation rate in the world. It was liquidating more than 4 percent of its most valuable capital asset each year. Costa Rica is a very small country — at the time it had about 3.2 million people — but some remarkable public leaders were elected, such as Óscar Arias and José María Figueres. In 1986, Arias appointed the country's first minister of energy and environment, Alvaro Umaña; they shifted policies toward tax incentives for forest restoration and toward debt-for-nature swaps (in which a nongovernmental organization [NGO] arranges for a developing nation's foreign debt to be reduced in exchange for environmental protection).

In 1997, Costa Rica established the first national payment system for ecosystem services. The government set up a central fund that was dispersed to participating landowners who agreed to protect or restore their tropical forests for a 15-year

contract period. The fund now covers 10 percent of the land in the country, and the program is being modeled elsewhere.

S+B: Where did the money come from?

DAILY: A variety of sources. Some of it was private donations from people seeking to preserve rain forest. The national electric power utility [Instituto Costarricense de Electricidad] also invested. It needs forested slopes, especially in steep areas, to limit the rate of sedimentation growth behind hydroelectric dams. Hydro-power accounts for 85 to 90 percent of Costa Rica's energy production and consumption, and the nation also exports electricity.

The government put in place a 15 percent gasoline tax, used solely for this fund. It used loans from the U.K.'s Government Economic Service and the World Bank. And it invited companies with an interest in the country to pay in, if they felt they would gain from the availability of water and other resources. For example, some beer companies participated. So did some NGOs like World Wildlife Fund.

Only very low payments were offered to landowners — about \$50 per hectare per year — and the fund's sponsors expected a modest response that would give them time to work the kinks out of the system. But immediately they were vastly oversubscribed. They discovered a market for ecosystem protection that no one had been aware of. The recipients were largely private

landholders who gave up the opportunity to grow coffee, sugar, pineapple, or rice, or to raise cattle, in favor of these conservation payments, because they saw that their land would be more valuable in the long run. In fact, the program is still oversubscribed, and they're scrambling to build it up and make it more robust.

Around the same time, in 1997, Costa Rica also put in place the first national program of carbon tradable offsets. It is now one of two countries with the lowest rates of deforestation in the tropical world; the other is Bhutan. Many other countries are developing similar programs, especially in Latin America: Mexico, Brazil, Colombia, Ecuador, and El Salvador.

S+B: What about China?

DAILY: The impetus there was the massive flooding of the Yangtze River in 1998. It displaced or otherwise affected 250 million people and resulted in damages of \$20 billion, particularly to major economic centers downstream. Thousands died. The Chinese Academy of Sciences and the insurance company Swiss Re investigated the cause. They discovered that flood risk was exacerbated by extensive deforestation in the upper reaches of the water basin.

So the Chinese government set up a suite of programs called eco-compensation, designed to convert vast areas of cropland back into forest and grassland. They also imposed a logging ban throughout

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Yunnan Province, in southwest China, which they’ve just renewed. Through this and similar programs, they have committed to spending the equivalent of \$100 billion in eco-compensation.

The programs are quite innovative. For example, the Chinese government is implementing a national network of ecological-function conservation areas, which are protected areas like nature reserves, but designed around the natural capital assets supplying the most valuable services to people. The government’s highest priorities are the use of forests to regulate water flow for hydropower, irrigation, and flood prevention. When forests are cleared, the water from monsoon rains flashes off the land and is wasted, and can be quite destructive.

Another goal of eco-compensation is poverty alleviation. In rural areas, where a huge fraction of the population lives below the poverty line, the government is designing payments to reduce people’s vulnerability to fluctuations in rainfall and crop yield. And since the gender imbalance from China’s “one child” family planning policy has sensitized the government to the general problem of unintended conse-

quences, it’s also conducting surveys to find out whether these payments have had the intended effects on households’ financial and educational well-being, and on health and nutrition.

Maximizing Investment

S+B: The Chinese and Costa Rican efforts were large-scale, government-driven initiatives. What do they mean for the private sector?

DAILY: First, the writing seems to be on the wall that businesses will have to respond to these new government priorities. No policymaker wants to block development. Mining, agriculture and forestry, and infrastructure development will all continue. But there’s a new business model emerging, one that aims to harmonize nature and people, so that what we call development will increasingly be designed to optimize long-term investments in both ecosystem capital and built capital.

For example, in China, the ecological-function conservation areas indicate where industrial infrastructure and activity is permitted, versus where natural capital is protected. In Colombia, the national government is implementing a similar sys-

tem, revising resource licensing and mitigation requirements in mining, agriculture, oil and gas, transportation, forestry, and hydropower. In the U.S., in Oregon’s Willamette Valley — the main river basin in the state, which supplies water from Portland to Eugene — a major public-private partnership is looking at the future of land use in the basin.

In all three places, they’re mapping out scenarios that show the potential impact of decisions they want to make now.

S+B: How does that work?

DAILY: The examples I know best come from the Natural Capital Project, where we developed a software system called InVEST (integrated valuation of ecosystem services and trade-offs) to help with this process. Decision makers use the software to identify the most valuable ecological assets in a region, like forest lands for flood control or timber supply, and it will analyze how they might grow or shrink in value under different development approaches. For example, if the Willamette Valley opts for more urbanization and industrial growth, including more roads or rail lines, someone can model the impact on

carbon storage for climate stabilization, water quality for drinking and irrigation supply, biodiversity, scenic beauty (which is considered to be a big asset in Oregon), and property market value.

A corporation's decision makers might use the software to assess the risks and other implications of alternative sites for a major project. They can decide whether to convert land for industrial development or to invest in restoring it. What's the land really worth? What are the hidden values that can be tapped — or the liabilities if the land is not managed well?

These kinds of effects were written off as externalities in the past; now they're being factored into regulatory policies, such as those addressing climate change and flood control. But the tools didn't exist before to map out which parts of the landscape are worth developing and which are worth preserving. In a way, it's like the days when oil was first discovered. Land that had always seemed relatively worthless suddenly had a visible value.

S+B: Aren't many environmentalists skittish about putting a value on ecosystems?

DAILY: Some are. To them, it's a slippery slope that risks giving in to the "dark side" of economics with no ethics. A wetland with high flood control value might be protected, whereas one with only aesthetic and recreational appeal may not measure up against a shopping mall. I share these worries, but we need to work

pragmatically and confront the current situation. Let's face it, most major decisions are made on a cost-benefit basis, and natural capital is assigned zero value.

The natural capital approach presents a chance for nature to win big, and to meet people's needs at the same time. We'll never find these win-win alignments of conservation and economic development if nature remains a zero on corporate balance sheets.

The growing docket of win-wins in government and business policy backs the promise of this approach. These values are being factored into decisions around the world, and many businesses, I think, are starting to treat natural capital differently.

For instance, decision makers at insurance companies like Swiss Re are now aware of the environmental dimensions of the risks they insure. They can assess the flood risk resulting from farming or building practices across a broad landscape. BP and other resource-intensive corporations now have ecosystem services teams. And the Natural Capital Project is inundated with demand for ecosystem analyses.

S+B: The amount of investment necessary for the preservation of ecosystems and the diversion of land to natural uses must be immense. Where will the money come from?

DAILY: It will come from recognizing the unbearable risks and costs that result from the ongoing hemorrhaging of natural capital, from rec-

ognizing the significant return on strategic investments in natural capital, and from designing finance and policy mechanisms that reward the investors.

This is conservation for the 21st century. It's not like the conventional, donor-driven approach, in which the ability to save Earth's life support systems rests on finding generous people to underwrite the whole deal. This strategy has bought some critical time, but if we depend only on donors, conservation is ultimately doomed to fail.

We are talking today about a broad-based issue: protecting critical public services, like climate stability, flood control, and food security. Two-thirds of our crops and most natural vegetation need active and diverse insect populations to transfer pollen. Spending money on species diversity sounds impractical, until you learn how much money California's almond producers have lost because of the collapse of bee populations.

Every locality has its own symptoms of decline to manage. If you live just about anywhere that's not soaked with rain, you are dealing with water scarcity. If you're in a hurricane belt, you know about climate change and the risk of intensified storms. In the western U.S., we're having massive wildfires. You can never say exactly which fires resulted from human-induced climate disruption and which were just bad luck. But the overall pattern is undeniable. At the same time, there are more and more new practical

solutions. These solutions have the same elements — prices and table manners — wherever you look.

Food and Drug Dilemmas

S+B: You mentioned the insurance, mining, and forestry industries as early adopters. But in other industries the solutions seem more difficult. For instance, agriculture, fishing, and food products companies are going to be under pressure to supply more meat, fish, grain, and sugar around the world.

DAILY: I agree. We will soon have 2.5 billion more people to feed, just as climate disruption makes agriculture harder. There's a major international meeting every week on food and the environment. A lot of agricultural companies take this seriously; they're looking for ways to change production practices to be economically profitable but also much more sustainable. It comes down to quantifying the costs and benefits of alternative practices. There are a range of options, and a lot of research going on.

The conventional wisdom still promotes intensification: high use of fertilizers, herbicides, and pesticides, along with large amounts of water, mostly through irrigation, to achieve high yields. This approach has been great, in one sense, because it prevented massive famine despite the huge population growth that we've seen since the 1960s. But the "green revolution" of intensive agriculture also resulted in massive off-farm consequences at levels that can't possibly be sustained.

The first major ecological "dead zone," in the Gulf of Mexico, was reported in 1996. Oxygen was depleted to a level that killed off the fish and promoted very dangerous

blooms of toxic algae. Since then, hundreds of other dead zones have been discovered, in oceans and lakes all over the world. Water of poor drinking quality is coming out of river systems, and a large extinction crisis is under way. All of this can be traced, at least in part, to intensive agricultural practices.

Now the challenge is to increase those already high food yields, while greatly reducing net environmental impacts and maintaining other benefits from the land. Thus a new agricultural model is emerging. It means looking at a farmer not just as a producer of a crop like wheat, wool, or corn, but as a steward of a variety of commodities. In this new model, farmers are paid for water quality, flood control, carbon sequestration, and biodiversity conservation, as well as for food. They tend their forests as well as their fields. From an economic perspective, it makes a lot of sense to use land in this more diverse way. In a typical farmstead, some land is optimally suited for agricultural production, but other land is better suited to other forms of natural capital.

There is a long way to go in realizing this model, especially in the face of projected population growth, dietary shifts (toward more protein), and climate change. But it could help buy the time we need for human population growth to reach the peak that's projected for mid-century and start to humanely decline.

At the same time, agricultural companies are starting to recognize the potential in crop diversity. About half of the annual increase in crop productivity comes from genetic innovation, and that relies on having access to the wild relatives of crops. For example, to improve corn yields, you need diverse forms

of maize that are often found in natural habitats. Food security also hinges on cultivating a wide array of nutritious and locally adapted crops that are no longer prevalent on our farmland or in our diets. They were replaced by a few crops — wheat, rice, maize, and soybeans — and we now need to revive the broader group.

S+B: What about the pharmaceutical industry?

DAILY: In the 1980s and '90s, many conservationists hoped that bioprospecting — the search for potent pharmaceutical ingredients — would be a silver bullet for stopping destruction of rain forests, coral reefs, and other ecosystems under siege. Unfortunately, many government–industry partnerships have gotten bogged down in intellectual property rights issues, and bioprospecting has proven more difficult than expected.

The truth is, it might not have been that lucrative anyway. I'm not an expert on drug development, but there are so many hurdles to clear for any widely used product. It can be expensive and risky; it means not just understanding how local human populations use plants for medicinal purposes, but also figuring out how to synthesize the active plant ingredients and take them to market. In the end, though we rely heavily on nature for pharmaceuticals, it's very challenging to promote the discovery and development of more chemicals this way while sustaining rain forests and other habitats.

Australia's Salty Soil

S+B: What role, if any, do you see for innovation in increasing biodiversity

“In the new agricultural model, farmers are paid for water quality, flood control, and biodiversity as well as for food.”

through technological means, preventing ecosystem destruction, or trying to reclaim “dead zones” and bring them back to life?

DAILY: I see a lot of promise. Work on restoration has picked up in the last five years in places like the Florida Everglades and Hawaii. In Australia, the movement for restoration has been led by farmers; it began as a response to Australia’s soil salinity crisis. Australia is a very old continent; it hasn’t been extensively glaciated in more than 80 million years. Its soil is very fragile and not necessarily fertile, and the introduction of European farming practices had devastating consequences. The settlers removed a lot of the forest, and without those trees acting to keep the water table low, it slowly rose up to the surface, carrying with it a lot of naturally occurring salts. It’s now costing hundreds of millions of dollars per year in damage to roads and other infrastructure, in farmland contamination, and in the salinization of water. The tap water in Adelaide is barely drinkable, it’s so laden with salt.

The goal now is to restore the hydrological cycle, draw the water table back down, and let the rain wash the salts out of the rooting

zone of crops. The expenses are justified by salinity control alone, but they also confer carbon sequestration, flood control, habitat diversity, and the other benefits that natural forests bring.

Once you reduce the harmful effects, nature can come back — that’s one of the most beautiful and inspiring things about it. We often marvel at how resilient the human spirit is, at least up to a point, in children who have been hurt. And this is also true for nature. There are definitely breaking points, but if you give her a chance, she will come back. You just have to make sure you give her the chance — and that we all give the next generation a chance — before it’s too late.

S+B: Imagine that you were addressing an audience of corporate executives and business school students. Besides what you’ve already said, what would be important for them to hear?

DAILY: I teach in the business school at Stanford now. The MBA students are very sharp, experienced, and ambitious — I found out as a Ph.D. student that you don’t want to play against the MBA soccer team! Many have been working in

corporate settings before coming to business school. Now they’re taking on big challenges, including restoration, and their sense of entrepreneurship is paying dividends, in both the ecological and the financial sense.

In the past, there were many lose-lose battles between business and environmentalists over the use of resources, and those battles are still going on, of course. But now many productive partnerships have developed that one couldn’t have previously imagined possible. These partnerships engage new, diverse kinds of leaders, who together are transforming conservation into a deep, global, profitable game-changing arena for business and policy innovation. The result is going to be better corporate investments, more streamlined public policies, and maybe a better chance of achieving both human and natural well-being. +

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