

SUMMARY OF ARTICLES ABOUT PETER RAVEN AND BY PETER RAVEN

Matt Ritter, March 2006



Third rock blues

Ecologist Raven warns of planetary catastrophe at Pollak lecture

By Ken Gewertz, Harvard News Office, March 10, 2005

In 1999 Time Magazine named Peter Raven a "Hero for the Planet." It's a good thing because, as Raven himself tells it, the planet really needs a hero.

Raven, the Engelmann Professor of Botany at Washington University in St. Louis and director of the Missouri Botanical Garden, delivered the Kennedy School of Government's 2005 Gustav Pollak lecture on March 3. His topic: "Biodiversity and Sustainability: How to Forge the Link."

Speaking in an energetic, rapid-fire style, Raven sketched in a statistical portrait of a world heedlessly stampeding toward ecological disaster. In 10,000 years, or, to put it in more comprehensible terms, about 400 generations, the human race has gone from 3 or 4 million, living in small scattered bands of hunters and gatherers, to its present population of 6.3 billion and rising.

In the past 50 years alone, the population has more than doubled, while soil erosion has increased by 20 percent, agricultural land has decreased by 20 percent, one-third of the world's forests have been chopped down, carbon dioxide has increased by one-sixth, and there's been 7 percent loss of the stratospheric ozone layer.

If the Earth's carrying capacity were a checking account, we'd be overdrawn. Based on calculations by ecologists William Rees and Hans Wackernagel, it would take 1.2 Earths to support our current population. The fact that we have only one planet at our disposal means that large portions of humanity are undernourished.

Some look to development to correct the problem of unequal distribution, assuming that in time the developing world will reach the standard of living that the developed world already enjoys, but Rees and Wackernagel's calculations demonstrate the folly of such belief.

"To support everyone at the standard of the developed countries, we would need three Earths," Raven said. "To support everyone at current standards if the population doubled [a milestone we are likely to reach by the mid-21st century] we would need six Earths. To support double the current population at the standards of the developed countries would take 12 Earths."

The stress that billions of hungry humans exert on the environment is driving plant and animal species to extinction at a rate unprecedented since Earth's collision with a giant asteroid wiped out the dinosaurs. Over Earth's history, the average extinction rate has been 10 species per year, said Raven. But between 1600 and 1950, it has averaged 100 per year. "Currently, we are losing thousands of species every year and soon it will be tens of thousands. At this rate, two-thirds of Earth's species will be gone by the year 2100."

Most of these extinctions are the result of habitat destruction, but there are other factors as well. Overfishing, overgathering of wild herbs for the natural medicine market, the introduction of alien invasive species, and changes in habitat due to global warming are all taking their toll.

What makes it worse is that the majority of the species being lost are still unknown to us. Raven said that of the estimated 7 million to 13 million species on Earth, only about 1.6 million have been identified, and of those, only 100,000 are known to any degree.

Since biodiversity "supports life on Earth and makes it possible," this loss is a serious matter. "But by losing biodiversity, we could also be losing a substantial number of species that could help us develop a truly sustainable Earth," Raven said.

For example, genes from plant species yet unknown might help breeders develop hardier, more productive food plants that could help alleviate hunger and lead to more sustainable agricultural policies. Medicines from plants could lead to breakthroughs in the treatment of diseases that afflict people in less developed parts of the world.

Because there is such disparity in the level of consumption between the rich and poor nations, the developed world bears a disproportionate responsibility for curbing its appetites. Those who live in the United States, Canada, Great Britain, and the other developed countries - which together account for only 23 percent of the world's population - use about 80 to 90 percent of the Earth's resources. And when it comes to wasting energy, the United States outstrips all rivals.

"We use twice as much energy as Germany, France, England, Switzerland, and the other developed countries, and it's hard to demonstrate that we get anything for it," Raven said.

What can be done to stave off what appears to be a rapidly approaching catastrophe? Establishing parks and protected areas, fighting invasive species, using seed banks to preserve threatened plant species - all of these measures will help and are important. But the key to altering the situation is a change in attitude, Raven said.

"The only way is to forge a world that is equitable and just. If poverty continues, there is no real hope of preserving biodiversity. In a high-consumption society like the United States, we can't solve the problem from the top down. Sustainability has to come from the bottom up."

Raven warned against relying too much on technology to cure our environmental ills.

"So far, technological advances have left us with a world where many people are starving. Technology is extremely important, but it would be a mistake to assume that it can solve everything."

Raven, a scientific prodigy who became a member of the California Academy of Sciences at age 8 and at 15 discovered a subspecies of the heather family that had not been seen for 50 years, puts a great deal of stress on education, particularly about the local environment.

"I think if you imbue children with a love of nature, they will want to do the right thing."
But the most important change in attitude for Raven is the realization that we do not have multiple Earths to sustain our growing population, and the fact that we are all inhabitants of this one precious planet unites us in a way that we have yet to fully realize.

"People are not yet willing to regard their destiny as shared and to take actions for the common good. We can only hope that in time a change in our attitude will become inevitable."

Source: <http://www.news.harvard.edu/gazette/2005/03.10/07-raven.html>

Ringling the alarm for Earth

Leading botanist Peter Raven calculates that species crucial to the survival of the human race are in steep decline. Tim Radford meets a man dubbed a 'hero of the planet'
Thursday July 14, 2005 The Guardian

Peter Raven is a botanist. He knows about photosynthesis, primary productivity and sustainable growth. He knows that all flesh is grass; that the richest humans and the hungriest alike depend ultimately on plants for food, fuel, clothing, medicines and shelter, and that all of these come from the kiss of the sun on warm moist soils, to quicken growth and ripen grain.

So botanists such as Raven begin with the big picture of sustainable growth and can calculate to the nearest planet how much land and sea it would take to sustain the population of the world if everybody lived as comfortably as the Americans, British or French. The answer is three planets.

The global population is about to soar from 6 billion to 9 billion in less than a lifetime. Around 800 million humans are starving, and maybe 2 billion are malnourished, while 3 billion survive on two dollars a day.

Valuable agricultural land is being poisoned or parched or covered in concrete, soils eroded, rivers emptied and aquifers drained to feed the swelling numbers. Something has got to give, and the first things to go are many of the plants and animals.

By many, Raven means perhaps half to two thirds of all the other species on the planet in the next 100 years. There could be 10m different kinds of fern, fungus, flowering plant, arthropod, amphibian, reptile, bird, fish and mammal on Earth. Nobody knows. People such as Raven, director of the Missouri Botanic Gardens in St Louis, are doing their best to count and preserve them.

But the human population is growing at the rate of about 10,000 an hour, and each human depends on a hectare or two of land and water for what economists now call "ecosystem services" - the organisms that ultimately recycle waste and deliver new wealth to provide oxygen, fresh food, clean water, fuel, new clothes, safe shelter and disposable income.

Some of these organisms are now being chased to oblivion by human population growth at levels that ecosystems cannot sustain.

Ecosystems, he says, can be whatever you like. Hedgerows in Hampshire are an ecosystem; so are weeds on a railway line at Hammersmith. Savannahs, grasslands, prairies, rainforests, dry forests, pine forests, uplands, heathlands, downlands, wetlands, mangrove swamps, estuaries, oxbow lakes and coral reefs are all ecosystems, and they survive on diversity. The greater the variety of microbes, plants and animals in an ecosystem, the more resilient it is and the better it works for all, including humans. So it would not be a good idea to evict at least half of these creatures, especially if nothing is known about them. But, Raven says, that is what is happening.

There are ways of confirming species loss, even if it cannot be established how many species there were in the first place. Look at the vertebrates and molluscs in fossil records, Raven says, just for the past 65m years or so. "You find that the average life of a species is two to three million years and you get about one species per million becoming extinct per year in the fossil record. Those particular groups are a small sample, but they are a real sample," he says.

"Then you can start with the literature in about 1600, when people began to care enough about organisms to be able to document them well, and for the groups that they were documenting - birds, mammals, amphibians,

reptiles, butterflies and plants - then you can say, 'What was the rate over the past 400 years? It's tens of times or hundreds of times the level it was before.'

That works out at hundreds of creatures per year over the past 400 years, and even more when humans, rats and other invaders started colonizing islands: 2,000 species have vanished from the Pacific basin alone since the Polynesians got there 1,200 years ago.

There is another way of checking, Raven says, pioneered by, among others, sociobiologist and evolutionary psychologist Edward O Wilson. There is a logarithmic relationship between the area of habitat and the species that inhabit it. Measure a patch of forest and count a sample of the species in it. Then compare it with another patch of forest 10 times smaller. The smaller one will have only half the sample species count. This has been shown in thousands of individual observations, he says. So destroying forests, piecemeal, is a way of extinguishing creatures.

There are various wild creatures that get along with humans and follow them everywhere: cockroaches, fleas, ticks, rats, cats, pigs, cattle, scavenger birds, lusty weeds. These invade little islands of ancient biodiversity, take over, and see the natives off the premises. And not just islands: one-third of all endangered plants in the continental US are threatened because of alien invaders, Raven says. In Hawaii, it is 100%.

Global warming is not going to help, either. What happens to the unique assembly of plants in the Cape region of Africa as the thermometer rises? They cannot migrate south. There is no land south of the Cape. So many will perish.

Ecosystems are not static. They change, naturally. They burn, are grazed or browsed, they regenerate, flood and silt up. But left to themselves, they go on providing services that humans and other creatures value. A mangrove swamp provides a habitat for shrimps. It cannot be improved by draining it for a tourist beach, or building a large city on it. Its natural value would be dissipated.

"An ecosystem itself undamaged is very, very resilient, and the more simplified it gets, the less resilient. Globally, what we are doing is simplifying them all, simultaneously, which is a very dangerous large-scale experiment," Raven says.

Plants are a lifelong obsession of Raven - any plants. "I was so excited and pleased by so many kinds of plants where I was first getting used to them as a teenager, and even now I can look at individual kinds of plants and be very, very excited.

"The florid nature of a really beautiful orchid or some kind of very rare plant that you see for the first time is really amazing. There are some Chinese monkshoods, for example, in a garden outside my office, and every year they come up and each time I see them I just get completely excited by the intricacy of their flowers, and how beautiful they are, and the fact that they are blooming.

"Then when I see photographs of really bizarre species of monkshoods from high elevations in southern China, I just say, 'Oh my gosh.' "

Raven was born in China in 1936 and educated in California. "I grew up in San Francisco and took plants and collected them - and then through the rest of the Pacific states - and it never occurred to me that things were becoming extinct rapidly. I thought of the world as a natural place divided between cultivated and urban areas and what have you, and in the 1950s, the global population was far less than half of what it is now and certainly standards of affluence were nothing like they are now. By the mid-1960s, we really began to think in terms of environmental problems."

Even then, the concerns were more about the domestic environment, how people lived, the gap between rich and poor, and the dramatic, all too visible swelling of the human investment. Population growth rates were moving towards the highest percentages the world had ever seen.

"I remember an article in the New Scientist in the mid-1960s, where a physicist had calculated that at the rates of growth then prevalent, in something like several hundred years the mass of human bodies would be expanding away from the surface of the Earth at the speed of light, which began to put a fine point on it," he says. "By the end of the 1960s, it was beginning to become evident that species were becoming extinct rapidly."

He got letters about extinction from Norman Myers (once a district officer in Africa, now a professor at Green College, Oxford) which provoked some serious thinking.

In 1972, Raven chaired a National Science Foundation committee on the future of systematic and evolutionary biology. By then, it was obvious that tropical forests were being lost, and very rapidly. "Since we knew far less about them than we did about organisms found anywhere else, it was obvious that if we were going to derive biological generalities and really understand the structure of life on Earth, we needed to understand the interactions between them, the ways that they evolved, whether the kinds of behaviors that took place in them were like those in the well-known temperate communities or not," he says.

Raven went from Stanford University to the Missouri Botanic Gardens in 1971, and began turning a small city recreation with one or two researchers into a world-class research institution - mentioned in the same breath as Kew and New York Botanic Gardens - with 50 scientists, 100 support workers and big research projects in places such as Madagascar.

He has, for the past three decades, been one of a highly vocal scholarly group that has banged the drum for the environment. Time magazine dubbed him a "hero of the planet". He can - and on public platforms does - paint an alarming picture of the great human takeover; the domination, by just one species, of a home fashioned by 3bn years of evolution to be shared by 10bn species. The world is clearly becoming more homogeneous, Raven says. "But the way I see it, we are not dying. We are simply losing opportunities, and at some point we have got to become sustainable. The choice is not whether we are going to reverse things. They are not going to be reversed. The real choices are where to stabilize it or how far to go."

As he keeps pointing out, the human species is living as if it had more than one planet to occupy. Forty years ago, at Stanford, he and colleagues tried to calculate the economic cost of exporting humans to a star system likely to be orbited by habitable planets. They worked out that it would cost the entire gross economic product of the planet to ship just 12 people a year to Proxima Centauri or beyond. His message for the planet is, "Think, look at the big picture, and think again".

"If both the population and standards increase, then obviously you come up with an impossible picture, which is a clear signal that we must [change]. It is not a matter of choice, it is not a matter of social justice alone, it is not a matter of morality, it is not a matter of creating a sustainable world so that industrialised countries can benefit from it.

"We must reach a sustainable population level, sustainable levels of affluence or consumption, and we must find technologies that replace the ones we are using now."

Source: <http://www.guardian.co.uk/life/interview/story/0,12982,1527622,00.html>

Raven: Teach about the environment in all majors

By Roger Segelken, May 6, 2004

The topic for Missouri Botanical Garden Director Peter H. Raven's 2004 Iscol Distinguished Environmental Lecture on April 29 was "Biodiversity, Sustainability and Cornell." His Call Alumni Auditorium audience listened through an hour of gloomy statistics and dire predictions to hear what Cornell can do to help an imperiled planet. The answer from the renown conservationist was, in a word: education.

Regarding biodiversity, Raven said, "the situation today is so awful, so threatening to human future civilization," and it probably will get worse. He cited numbers for species extinctions, starting with the fossil record, which shows that "hard" organisms leaving fossil evidence apparently went extinct at a worldwide rate of about 10 species per year throughout prehistory. As humans achieved ascendancy on the planet, the species extinction rate rose to around 100 per year, Raven said, and currently several thousand species disappear every year. That annual rate soon will rise to tens of thousands, he predicted, noting that millions of species have yet to be identified and cataloged.

A leading cause of biodiversity loss -- second only to habitat destruction from land development, Raven said -- is the arrival of alien, invasive species -- things like the zebra mussel, an aquatic nuisance, and purple loosestrife, which out-competes native plants in North American wetlands. Coping with invasive species costs an estimated \$140 billion a year in costs to the American economy, nearly as much, Raven noted, as U.S. expenditures on law enforcement. "Biodiversity will only survive in a world that has reached a state of sustainability," Raven said. "If we're going to base sustainability on biodiversity, it's pretty dumb of us to be killing [biodiversity] off at such a fast rate."

Yet, biodiversity holds little interest for starving people in impoverished regions where the first priority is keeping their part of the human family from going extinct, Raven observed. Worldwide, one out of eight people is starving, "their bodies wasting away while the brains of children cannot develop properly," he said, and one of two humans, worldwide, is malnourished.

Getting back to Cornell, Raven displayed the university's list of goals for sustainable futures (see "Cornell University and the Environment" at <http://www.cfe.cornell.edu/cfe/cuenvironment.cfm>). He said many of the goals are being achieved, adding: "Cornell University should be very proud of its record of training people all over the world," particularly in Mexico, China and Brazil. And Cornell's campus and the surrounding community of Ithaca have a good record for conserving resources and encouraging energy-efficient transportation systems, he said. "You have one of the finest records in the environment of any institution in the world.

"But here's one," Raven said, "where you could do better." He called for environmental education in all the majors, not just fields where that curricular component might be expected, such as agriculture or natural resources. The University of Georgia system, with more than 40 campuses, teaches everyone something about the environment. Surely Cornell can do the same, he said. "Whether you're going to be a poet or a junk-bond salesman, the health of the environment will determine your future."

Raven spent two days on campus as part of his Iscol Lectureship, which brings prominent scholars, newsmakers, scientists and leaders to Cornell to address environmental issues of paramount importance to humankind. He met with students, faculty members and research staff, and participated in panel discussions, then delivered a second lecture April 30, titled "How Many Species Will Survive the 21st Century?"

Source: http://www.news.cornell.edu/Chronicle/04/5.6.04/Raven_cover.html

Peter Raven: A Sustainable Future Should Include Biotech

Ag Biotech Buzz, 2004

At age six, Peter Raven was already a budding botanist—roaming through fields in San Francisco to collect beetles, butterflies and plants so that he could study their life cycles. At age 65, Raven is director of the Missouri Botanical Garden in St. Louis, a leading institution for botanical research with a diverse horticultural display covering 79 acres.

Called a "Hero for the Planet" in a Time magazine article in 1999, Raven's main mission in life is to help preserve endangered plants and to advocate for conservation and sustainability—using the planet's resources to meet current needs without compromising the needs of future generations. Raven believes biotechnology has a role to play in ensuring sustainability.

"One of the modern discoveries that can and will contribute to agricultural sustainability is the production of genetically modified (GM) crops," says Raven, who has been director of the garden since 1971. And, he believes the need for sustainability is intensifying.

"We clearly are living non-sustainably by any measure," says Raven. "So we are not headed down the right path. But there is greater understanding of what is facing us that is prompting more people to look seriously at how we can attain sustainability."

Raven views the interaction people have with Earth much like a bank account and he sees humanity living off Earth's capital rather than its interest. For example, in the past 50 years, 20 percent of the world's topsoil has been lost and about one-third of the world's have been chopped down. At the same time, the extinction rate of plant species has jumped, and the world's population is exploding—hitting 6 billion in 2000 up from 2 billion in 1930.

"How the world is going to look in the future depends on the actions we take now," Raven said.

He feels agriculture is one area that especially needs to be studied. In addition, current agricultural methods stress water supplies, decrease the fertility of the land, and employ large amounts of pesticides.

"Agriculture, being that big, has to become sustainable for the world as a whole to be sustainable," Raven said. The more efficient agriculture is on presently cultivated land, the more opportunity there is to preserve biodiversity on non-cultivated land, he said. That is why he is in favor of using biotechnology to obtain sustainability.

To that end, the Botanical Garden is collaborating with the Donald Danforth Plant Science Center in St. Louis. The garden is supplying a wealth of knowledge to the Danforth Center in form of its library of books and plant specimens.

"This information allows people to work on plants in any way they want, whether it's anthropology, archeology, pollination systems or the feeding habits of chimpanzees," Raven explained. "In cooperation with a place like the Danforth Center, we can provide knowledge about plant diversity and they can provide a higher order of application of what is known about this diversity."

Raven sees biotechnology only as part of the solution to our sustainability problem. "I want to emphasize that for the goal of sustainable agriculture, there are many, many ways we need to approach it. And many of these ways have nothing to do with crops themselves."

For example, countries need to help educate rural people to cultivate their land more wisely. In addition, there needs to be a better way to allocate water resources and topsoil needs to be protected.

Importantly, the U.S. and other wealthy nations need to look at their role in resource consumption and how environmental degradation is often about how richer countries use up the natural resources in poorer countries.

"The U.S. has 4.5 percent of world population. Yet, we use 25 percent of the worlds' resources to support our standard of living," Raven said. "Our kind of standard of living can't be projected worldwide. It would require more land than the Earth has."

The U.S., in fact, depends on countries all over the world for its prosperity, Raven points out. As a result, he believes this country should be interested in worldwide sustainability because what happens in other countries "it affects us directly."

Source: <http://pewagbiotech.org/buzz/display.php3?StoryID=39>

Peter Raven Profile

GM Watch, 02 March 2006

Peter Raven is the Director of the Missouri Botanical Garden and a past President of the American Association for the Advancement of Science. He has been a recipient of numerous awards and honors. Time magazine honored him for his tireless championing of conservation and biodiversity as a 'Hero for the Planet'.

Although Raven is passionately concerned about the extinction of living organisms - warning that two-thirds of the world's species may be gone by the middle of the next century, his solution to a problem brought on by carelessness and commerce, is simple - the mastery of biology allied to the power and efficiency of corporations. 'Major companies will be, are, a major factor if we are going to win world sustainability,' he told a journalist, and the commercial development and acceptance of GM crops is something he's convinced sustainable agriculture requires.

It's an issue on which he comes out fighting. In May 2003, speaking at the Natural History Museum in London, Raven attacked Greenpeace over its opposition to GMOs, telling his audience, 'Last month, the Congress of Racial Equality (CORE), one of America's most venerable and respected civil rights groups, confronted Greenpeace at a public event and accused it of "eco-manslaughter" through its support of international policies limiting development and the expansion of technology to the developing world's poor'. In fact, the once respected CORE was hi-jacked during the 1970s by elements that have since used it as a Republican right pro-corporate lobby.

If Raven is hard on Greenpeace, he's less critical when it comes to Monsanto. 'There is nothing I'm condemning Monsanto for,' he says. And he's praised the company's efforts to win public acceptance for GMOs, 'The company has . . . won many more believers around the world in what they're doing and attempting to do.'

An old friend of Raven's, geneticist Wes Jackson, says of him, 'I just wish Peter was more reflective... The fact that living substance, germplasm, can become the property of a corporation is going to come at a cost. I think the boundaries of consideration need to be broader than Peter's willing to make them. In a certain sense he's a paid traveling salesman for Monsanto.'

Raven has good reason to smile on the company. According to Time magazine, 'When Raven first came to the garden in 1971, he had 85 employees and a budget of \$650,000. Today there are 354 people on staff, and the budget is \$20 million.' That expansion has been assisted by millions from the U.S. Department of Agriculture and substantial corporate support, not least from Monsanto.

The Garden, in fact, is based in Monsanto's home town of St. Louis. According to Raven there are other reasons for the strength of Monsanto's support. Although, 'we don't do biotech work other than bioprospecting', he says, 'The basic research we do here at the Garden makes us a major resource for the biotechnology industry'. Raven, together with Monsanto, was also the driving force behind a nearby plant biotech research institute on whose board he sits.

The Raven-Monsanto equation includes the Garden's multimillion-dollar research centre - The Monsanto Center. And it doesn't stop there as the St Louis' paper, The Riverside Times, noted in 1999, 'The Garden received \$3 million from Monsanto in their last fundraising campaign... Monsanto also contributed land and a large chunk of the \$146 million startup money for the Danforth Plant Science Center [a project Raven was instrumental in getting off the ground]. Monsanto matches its employees' contributions to the Garden (\$225,000 last year) and contributes to the operating fund (\$25,000 last year). Trustees give privately, too, and in past years the Garden has had Monsanto CEO Robert Shapiro, Monsanto vice president Tom K. Smith and Monsanto research-and-development director Howard Schneiderman on its governing board. Now the Garden is collaborating with Monsanto's nutrition sector on a food library, collecting samples of all plants used worldwide as foods and medicines. (The World Resources Institute lists Monsanto as a bioprospector since 1989 and lists

its collector, as of 1993, as the Missouri Botanical Garden.) When Confluence, an environmental quarterly, criticized Monsanto, the Garden's PR woman pulled it from their literature table.'

At the time that was written, Raven's wife was Monsanto's Director of Public Policy, Kate Fish, leading to jokes that even Raven's sex life came corporate-sponsored.

Raven played a key role in getting the Golden Rice publicity bandwagon rolling, after its inventor Potrykus had his paper publicizing the project rejected by the journal Nature.

Raven is a Member of the Vatican's Pontifical Academy of Sciences and was among the invited speakers at a special Vatican study seminar held in November 2003 entitled GMO: THREAT OR HOPE?. The seminar came under attack for bias.

Source: <http://www.gmwatch.org/profile1.asp?PrId=191>

Ecological Science and the Human Predicament

Science 30 October 1998: Vol. 282. no. 5390, p. 879

When we began our careers, good science consisted of two basic activities: (i) doing first-rate research and (ii) publishing it in the technical literature for the benefit of scientific colleagues. We firmly believe that a third activity must now be added by all scientists: (iii) informing the general public (and, especially, taxpayers) of the relevance and importance of our work. We are convinced that this applies to even the most esoteric of "basic" research, because understanding how the world works is fundamental to both satisfying natural human curiosity and solving the human predicament.

As ecologists, we further contend that, because of the central role ecology must play in resolving the predicament, the structure of rewards in our discipline must be changed. Now all field research is done in systems altered by *Homo sapiens*, and the degree of disturbance is increasing rapidly virtually everywhere. Sadly, in our countries of origin, even areas nominally designated to preserve biodiversity are to a large extent inadequately inventoried, monitored, and protected. There are many tasks in support of just those areas that can and should be carried out or aided by academic ecologists, and career incentives need to be developed to achieve this. Furthermore, incentives need to be found to promote interdisciplinary involvement of young ecologists, because so many of society's greatest challenges lie at the interface of ecology and the social sciences.

In our view, it is necessary to train students in ecology who will be ready and willing to devote part of their professional lives to stemming the tide of environmental degradation and the associated losses of biodiversity and its ecological services, and to teaching the public about the importance of those losses. We believe that such efforts should be rewarded as part of the process by which ecologists are considered for academic posts, granted tenure in universities, elected to membership in learned societies, and so on. Ecology is a discipline with a time limit, because much of what we study, upon which society is dependent, is fast disappearing. Ecologists have a responsibility to humanity, one that we are not yet discharging adequately. It is incumbent on senior ecologists to take the lead in pressing for the needed transformation--and we pledge ourselves to that task.

Letter Signed By: Fakhri Bazzaz, Harvard University, Cambridge, MA, USA; Gerardo Ceballos, Institute of Ecology, National University of Mexico, Ciudad Universitaria, Mexico; Margaret Davis, Department of Ecology, Evolution and Behavior, University of Minnesota, Minneapolis, MN, USA; Rodolfo Dirzo, Institute of Ecology, National University of Mexico; Paul R. Ehrlich, Department of Biological Sciences, Stanford University, Stanford, CA, USA; Thomas Eisner, Division of Biology, Cornell University, Ithaca, NY, USA; Simon Levin, Department of Ecology and Evolutionary Biology, Princeton University, Princeton, NJ, USA; John H. Lawton, Director, Centre for Population Biology, National Environment Research Council, Imperial College, Silwood Park, Ascot, Berkshire, UK; Jane Lubchenco, Department of Zoology, Oregon State University, Corvallis, OR, USA; Pamela A. Matson, Department of Geological and Environmental Sciences, Stanford University; Harold A. Mooney, Department of Biological Sciences, Stanford University, E-mail: hmooney@jasper.stanford.edu; **Peter H. Raven, Director, Missouri Botanical Garden, St. Louis, MO, USA;** Joan E. Roughgarden, Department of Biological Sciences, Stanford University; Jose Sarukhan, Institute of Ecology, National University of Mexico, E-mail: sarukhan@servidor.unam.mx; G. David Tilman, Department of Ecology, University of Minnesota; Peter Vitousek, Department of Biological Sciences, Stanford University; Brian Walker, Division of Wildlife and Ecology, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Canberra, Australia; Diana H. Wall, Director, Natural Resource Ecology Laboratory, Colorado State University, Fort Collins, CO, USA; Edward O. Wilson, Museum of Comparative Zoology, Harvard University; George M. Woodwell, Director, Woods Hole Research Center, Woods Hole, MA, USA"; Peter H. Raven, Director, Missouri Botanical Garden, St. Louis, MO, USA; Joan E. Roughgarden, Department of Biological Sciences, Stanford University; Jose Sarukhan, Institute of Ecology, National University of Mexico, E-mail: sarukhan@servidor.unam.mx; G. David Tilman, Department of Ecology, University of Minnesota; Peter Vitousek, Department of Biological Sciences, Stanford University; Brian Walker, Division of Wildlife and Ecology, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Canberra, Australia; Diana H. Wall, Director, Natural Resource Ecology Laboratory, Colorado State University, Fort Collins, CO, USA; Edward O. Wilson, Museum of Comparative Zoology, Harvard University; George M. Woodwell, Director, Woods Hole Research Center, Woods Hole, MA, USA

Biographical Sketch of Peter Raven

Peter H. Raven is Director of the Missouri Botanical Garden and Engelmann Professor of Botany at Washington University in St. Louis, Missouri. The Garden, which opened in St. Louis in 1859, is the nation's oldest botanical garden. Dr. Raven has been director for more than 35 years and has been recognized for making it a world-class display, educational and botanical research institution devoted to conservation and the preservation of biodiversity. Described by TIME Magazine as a "Hero for the Planet," he champions research around the world to preserve endangered plants and is a passionate and leading advocate for conservation, biodiversity, and a sustainable environment.

In 2004, Dr. Raven was appointed to the President's Committee on the National Medal of Science. He has served as chair of the National Geographic Society's Committee for Research and Exploration, was a member of the President's Committee of Advisors on Science and Technology, past president and chair of the American Association for the Advancement of Science, and served for 12 years as Home Secretary of the National Academy of Sciences. Recent awards include the ANZAAS Medal for Scientific Achievement, the Royal Horticultural Society's Veitch Memorial Medal, Japan's International Cosmos Prize, and the National Medal of Science, America's highest award for scientific accomplishment.

Dr. Raven completed his undergraduate work at the University of California, Berkeley, received his Ph.D. from the University of California, Los Angeles, and taught for nine years at Stanford University. The author of numerous books and publications, both popular and scientific, he has written extensively about his concern of plant extinctions that are increasing exponentially and the means of averting them.

Other Online Article and Resources About Peter Raven

Scientific American Frontiers

Science Hotline, Scientists Answer Your Questions

Questions to Dr. Raven, 2002

<http://www.pbs.org/saf/1304/hotline/hraven.htm#answers>

Interview with Dr. Raven

Sustainability News 2002, National Parks Service

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