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Reference List

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Section: News Focus

BIODIVERSITY**UP FOR THE COUNT?**

An odd combination of high-tech gurus and senior taxonomists is planning an ambitious--some say quixotic--effort to catalog and describe all species on Earth

BOSTON-- Making big lists is big science today. Backed by the latest in high-tech tools and millions of dollars in public and private funding, molecular biologists are busily pinpointing tens of thousands of genes, while astronomers are mapping millions of galaxies. So pity the taxonomists, who have yet to organize something equivalent for their field: a comprehensive, well-funded, highly coordinated effort to count and describe Earth's species.

But that will change if a small group of San Francisco high-tech movers and shakers has its way. Allied with senior researchers in the field, including Harvard professor emeritus E. O. Wilson and Peter Raven of the Missouri Botanical Garden, they are brainstorming an ambitious listmaking effort that could surpass the Human Genome Project or the Sloan Digital Sky Survey in complexity.

Their goal is to count every last plant, and microbe on Earth, including the undiscovered ones that account for perhaps eight in 10 living species. Creating this biological master database, they estimate, would take at least 20 years, cost some \$20 billion, and require the help of thousands of researchers and amateur naturalists around the world. "The idea is simple: a Web page for every species," says Kevin Kelly, who started *Wired* magazine

and who chairs the new All Species Foundation dedicated to the task.

The foundation assembled two dozen scientists last week at Harvard to help figure out how to tackle such a mammoth endeavor. As was clear at the meeting, the bold proposal is raising both the hopes and hackles of taxonomists. "This is well intentioned but incredibly naive," says Cristian Samper, deputy director of the Smithsonian Tropical Research Institute in Panama. Not only is the proposal impossibly ambitious, said many, but unlike counting genes or galaxies, counting species involves complex political, educational, and legal issues--ranging from the shortage of trained researchers in developing countries to concerns about biopiracy. And gaining public and private support for a \$20 billion project--particularly during an economic downturn--strikes some as quixotic.

But the assembled scientists were also excited by the prospect of new funding, advanced computer tools to handle huge amounts of data, and an aggressive attempt to interest the public and politicians. And they clearly welcome any assistance Silicon Valley has to offer. "Systematic classification of biodiversity is at the beginning of a technology-driven revolution that will take it into the mainstream of science," Wilson told the participants. "If we build it, they will come."

The all-species-count concept sprouted not from a meeting of taxonomists but from a San Francisco dinner party in the spring of 2000. Former Microsoft chief technology officer Nathan Myhrvold invited friends such as Kelly of the All Species Foundation and Stewart Brand, who created the Whole Earth Catalog and now directs the Global Business Network, to discuss which philanthropic ideas might be worthy of large donations. Kelly tossed out the biological inventory idea, "but I assumed it was already being done," he says.

Bits and pieces are. Ecologist Daniel Janzen of the University of Pennsylvania in Philadelphia made a start 7 years ago in a project--the All Taxa Biological Inventory--to catalog every life-form in one part of Costa Rica, but the effort fell apart amid disputes over funding and other issues. Now an international project called Species 2000 is working to inventory the 1.75 million known species by drawing on existing databases. So far, with funds from public and private sources, the project has completed 250,000 and hopes to reach 500,000 by 2003. In Copenhagen, the Global Biodiversity Information Facility, a new international organization, is gearing up to add new biodiversity data online.

But nobody had proposed a single effort to count all the world's species by a particular deadline, Kelly and Brand learned when they consulted the experts. They were also astonished to learn of the low-tech nature of the field. "Taxonomy is still done the same way it was during Darwin's day" an incredulous Kelly told Science.

Kelly and Brand have set out to change that--by making taxonomy "cool," Kelly says. With support from members of the California Academy of Sciences, they launched the foundation last year. Brand and his wife, foundation business consultant Ryan Phelan, kicked in about \$40,000 and Kelly about \$20,000. They have since won a \$1 million grant from a wealthy entomologist. They also recruited Brian Boom, former vice president of botanical science at New York's Botanical Garden, to be the foundation's chief executive

officer. "The refrain is think big, start small, act now--and don't deliberate it to death," says Boom. They've picked a target of 25 years to complete the effort.

At the Harvard meeting, taxonomists suggested they start by taking on some manageable but still ambitious projects. For instance, the foundation could support four or five intensive surveys in particular countries; alternatively, it could take a novel approach and focus on a single species, such as the wood rat or the salmon. The idea is to catalog all the species that live in, on, or around the chosen animal. Along with yielding valuable scientific data, that approach could capture the public's imagination, said Kelly and Boom, who are counting on outside help.

"Let the rest of the world become naturalists, with the Web as the unifying glue," says John Pickering, an ecologist at the University of Georgia in Athens. Amateurs could build "life lists" of new species seen or discovered, much as bird watchers do today, forming a critical base for research.

Counting all species would indeed require legions of taxonomists and parataxonomists as well as massive but user-friendly computer databases. And those legions would have to be concentrated in the most biodiverse parts of the world--the developing countries--where both trained naturalists and computer access are scarce. The foundation hosted a meeting in Mexico City earlier this fall to underscore its desire to involve developing-country scientists. But good intentions have failed before--such as in Costa Rica. And developing nations are concerned that Western countries might take advantage of their biodiversity for profit's sake (Science, 9 May 1997, p. 893).

And then, of course, there's the money. Whether the odd combination of high-tech gurus and academic taxonomists can ratchet a modest foundation into a multibillion-dollar international effort remains to be seen. Kelly hopes to raise \$10 million by the end of 2002, mainly in large chunks from foundations and wealthy individuals. Phelan adds that the goal is to raise \$50 million to \$100 million in the next 3 years. "If we can deploy \$3 million next year, we could kick-start things and get some traction," she says.

Ultimately, the scale of the effort will require national and international funding. In the United States, at least, that may be hard to find: Biologists are still smarting from congressional rejection of the proposed National Biological Survey. Lawmakers feared a species inventory could ultimately infringe on the rights of owners of private property. But Raven, who moderated a session at the Harvard meeting, says that Kelly's foundation is an encouraging step. "The All [Species Foundation] effort is a publicity gold mine, if played right," he says.

Many of the taxonomists at the Harvard meeting scoffed at the idea that an all-species count could be done in 25 years. But whether or not the California high-techies can pull it off, senior researchers welcome the nascent foundation and its infusion of funds. "People are spread out, underappreciated, and consider themselves fly or beetle or butterfly people rather than taxonomists," says Scott Miller, entomology department chair of the Smithsonian's National Museum of Natural History. The big-list idea and help from Silicon Valley might prove just the tonic needed to give purpose, direction, and unity to a tradition-bound field.

PHOTO (COLOR): On the ascent. Isabella Kirkland's painting combines a host of invader species, such as the ring-billed gull, crowding out biodiversity.

PHOTO (BLACK & WHITE): Whole-species catalog. High-tech gurus Kevin Kelly and Stewart Brand are behind the push for a total species count in 25 years.

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By Andrew Lawler

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