Quantifying the Biodiversity Crisis

BY EILEEN CRIST

A RECENT ARTICLE in *Scientific American*—inauspiciously advertised on the cover as "The Truth About Today's Biodiversity Crisis"—illustrates some troubling repercussions of relying too heavily on expressing biodiversity losses in quantitative terms. The article, written by W. Wayt Gibbs, reports on quantitative estimates of extinction rates, the way these estimates are calculated, and how they have recently been called into question. A box of the article's highlights, titled "Overview/Extinction Rates," summarizes ostensible challenges to certain estimates and comparisons. Two of the three bulleted items read:

> ➢ Eminent ecologists warn that humans are causing a mass extinction event of a severity not seen since the age of dinosaurs came to an end 65 million years ago. But paleontologists and statisticians have called such comparisons into doubt.
>
> ➢ It is hard to know how fast species are disappearing. Models based on the speed of tropical deforestation or on the growth of endangered species lists predict rising extinction rates. But biologists' bias toward plants and vertebrates, which represent a minority of life, undermine these predictions. Because 90 percent of species do not yet have names, let alone censuses, they are impossible to verify. (Gibbs 2001)

Quantitative estimates of species losses have been both necessary and effective tools in calling attention to the biodiversity crisis. The question that arises, however, is whether too much emphasis on such estimates distracts from a deeper understanding of the Earth's ecological predicament.

Biodiversity denotes the richness and variety not only of species, but also of subspecies, varieties, hybrid species, populations, biomass, habitats, ecosystems, evolutionary surging, and genetic material that comprise the biosphere. The devastation of life that conservation biologists call the "biodiversity crisis" refers to the annihilation of native species and subspecies; shrinking populations especially of animals and plants; the strangling of organisms' natural ranges and animals' migration paths; the snuffing out of ecosystems, or their reduction to rudimentary forms; the pressure on, or conversion of, nearly every habitat of the planet; and the contraction and fragmentation of the spacious wilderness that is necessary for the continued flourishing, and evolutionary unfolding, of complex life on Earth.

In contrast, much recent discussion—and a seemingly inevitable wrangling over numbers—has focused on quantitative measures of species and extinctions: the number of extant species on Earth (Erwin 1982, 1991; Gaston 1991); the average lifespan of a species (Wilson 1992); the natural or background extinction rate (Raup 1986; Raven 2001); human-driven extinction rates in absolute and relative (to background extinction) terms (Myers 2001a; Wilson 1994); numbers of species expected to go extinct by a set date—for example by 2000, 2050, or 2100 (Myers 1979, 1988; Lovejoy 1980; Raven 1985); percentage of species vanishing per decade or century (Wilson 1994; Raven and McNeely 1998); and proportion of species extinguished per fraction of habitat destroyed (Simberloff 1986).

The predilection to quantify such key information stems from two sources: first, a generalized Enlightenment norm of science that identifies precision, objectivity, and impartiality with quantitative expressions of scientific findings; and second, more specifically for advancing conservation, the desire to show in succinct fashion that the biodiversity crisis is real and startling in magnitude. The time-honored and well-meaning intent of scientists' partiality to quantification notwithstanding, there is some indication that the biodiversity crisis numbers-game could backfire on conservation biologists' mission to educate the public and influence policy. As the *Scientific American* article noted, statisticians and paleontologists have begun scrutinizing the methods by which certain of the above estimates are generated. Indeed, it is no mathematical or logical feat to challenge them: life scientists who estimate biodiversity losses are the first to acknowledge the tentative nature of their projections (see Harwood 1982; Pimm 2001; Wilson cited in Gibbs 2001).

In particular, the article highlights two weaknesses of extinction estimates. Since the baseline of total species on the planet remains undetermined—between 5 million and 30 million—estimated proportions of species losses are bound to vary correspondingly. And since the paleontological record is incomplete, and the lifespan of different species diverge, quantitative estimates of the background extinction rate become vulnerable to challenge. Disputes over assumptions built into quantitative measurements constitute an intrinsic and salutary part of the scientific process—but in the case of the biodiversity crisis, they may be a distracting sideshow at a time when the onslaught on the Earth's natural systems is quickening in speed and intensity.

First, when estimates of human-driven extinction rates can be plausibly undermined by skeptics, the credibility of conservation biologists to quantify other key facts may become damaged as well. The overall tone of the *Scientific American* article conveys skepticism toward the reliability of extinction numbers—and thus toward the reliability of the science that generates them. After citing Robert May's keynote address—at the last meeting of the Society for Conservation Biology—as "painting a truly dreadful picture" about the prospects of biodiversity, Gibbs continues: "But is despair justified? *The Skeptical Environmentalist,* the new English translation of a recent book by Danish statistician Bjørn Lomborg, charges that reports of the death of biodiversity have been greatly exaggerated." Thus a statistician's challenge to extinction rates can unfortunately become a venue for a high-profile journal, like

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Scientific American, to question the credibility of a larger body of evidence—both quantitative and descriptive—which demonstrates that life's current predicament is grim.*

Another way that numbers may sidetrack attention away from the biodiversity crisis arises from the potentially compromising aftermath of making highly specific predictions by set dates. Such projections may, in any case, be moot if they cannot be verified, and they can be self-defeating for the conservationist cause, if anti-environmentalists can successfully brand them as overestimates. Indeed, guestimates about species losses have had largely emblematic force, because—though they are projected on the basis of scientific information and methods—they are unverifiable: the bulk of extinctions are occurring in the tropics where losses are virtually impossible to track.

A number of projections regarding species losses by 2000 were submitted during the last quarter of the twentieth century. Predictions affixed with an "expiration date" invite comparison with how things stand when the set date arrives. The *Scientific American* article insinuates that anticipated extinctions by the year 2000 were overestimates. After citing predictions made in 1979 by Norman Myers, and later by Thomas Lovejoy and Paul Ehrlich, of species losses upward of 20% by the turn of the twenty-first century, fish biologist Kirk Winemiller is quoted as saying, "I'm reasonably certain that the elimination of one-fifth of species didn't happen." (According to the article, Winemiller's evaluation was based on a review of the literature on extinction rates.) If species losses can be labeled overestimates, then a general impression is promoted that things are "not so bad after all"—exactly what a public presently more preoccupied with economic issues than ecological ones is open to hearing.

By deflecting attention from a *qualitative* appreciation of the human assault on the natural world, over-reliance on quantitative measures may hamper deep insight into the ecological predicament. E. O. Wilson's ballpark figure that 27,000 species are vanishing every year (cited in Gibbs 2001) reveals the stark reality of biocide; at the same time, however, since this estimate largely represents species disappearing in the tropics, it may implicitly convey the message that life's crisis is restricted to biodiversity hotspots that are (usually) "somewhere else." Awareness of the magnitude of pressures on nonhumans and their habitats all over the globe, including the North American continent, is correspondingly dimmed.

When quantitative measures obviate comprehensive appreciation of the conversion and overexploitation of the Earth's remaining wilderness and semi-wilderness, then surely emphasis on numbers risks missing the forest for the trees. Evidence for this confusion again appears in the article under discussion. The well-known figure of species-area relation—that the elimination of 90% of a habitat can lead to a 50% species demise—is challenged by purported counterevidence. Lomborg is cited as alleging that tropical deforestation is "not taking the toll that was feared," and that clearing 98% of the primary forest in the eastern United States and Puerto Rico did not wipe out 50% of the native birds of those habitats.

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* To its credit, the January 2002 issue of the journal features a section titled "Misleading Math about the Earth," which includes essays by scientists Stephen Schneider and Thomas Lovejoy who show that the author of *The Skeptical Environmentalist* is, in the words of the section legend, "out of touch with the facts."

Whether Lomborg misunderstands the species-area theory (as conservation biologist Stuart Pimm is quoted to argue) overlooks a crucial point: that destroying ancient forests is implicitly cast in a benign light if projected extinctions (purportedly or actually) fail to materialize, or if forest species hang on, in vastly reduced populations, in the impoverished environments that replace their homelands.

By casting doubt on anticipated species losses, the chief engine driving the biodiversity crisis—the ruination of wilderness—can be hidden under a cloak of controversy about numbers. This is exactly what Lomborg attempts in his chapter on biodiversity which is bent on disparaging estimates of extinction rates. While his statistical methods and conclusions have been challenged as faulty by prominent life scientists including E. O. Wilson (2001), Norman Myers (2001b), Thomas Lovejoy (2002), and others, his qualitative grasp of biodiversity destruction is even more wanting. In the subsection "What do we lose?" he focuses on tropical deforestation and tries to trivialize it by maintaining that perishing species "consist of beetles, ants, flies, microscopic worms and fungi, as well as bacteria, algae and viruses"—a list that is swiftly abbreviated to "insects, bacteria and viruses." Here Lomborg omits the annihilation of plants, and elsewhere in the chapter downgrades their significance by claiming that many medicines "used to originate in plants" but now are "produced synthetically." He also denigrates the importance of losing invertebrate species, veiling his dismissive attitude behind claims about the public's low estimation of invertebrates, and making no effort to cite scientific literature about their vital ecological roles. His repeated reference to supposed losses of "bacteria and viruses" is a particularly odious tactic in his belittling of the biodiversity crisis: the profligate and swiftly evolving nature of the bacterial world has, so far, preempted concern that human beings could significantly damage this realm; as for viruses, scientists are not even in agreement that they classify as "living"—but more to the point, the risk tropical deforestation poses is ferreting out potentially dangerous viruses, not driving them to extinction. Overall, Lomborg has zero grasp of the significance of dismantling ecosystems, the destruction of old-growth, or the eclipse of wilderness and wildness from the world.

In conclusion, I suggest that an exclusive focus—or even overemphasis—on quantifying extinction rates as the most incisive way to represent the biodiversity crisis can foil awareness of the ruinous overhaul underway: that the diversity of life is being jeopardized, at all its levels, by a consumption frenzy and population explosion that is making over the Earth into a *Homo sapiens* settlement of biologically impoverished and homogenized landscapes. ☾

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