

## Population Diversity and the Future of Ecosystems

Charles Mann's article "Extinction: Are ecologists crying wolf?" (Research News, 16 Aug., p. 736) focuses on arguments downplaying the loss of biodiversity that are largely irrelevant. Mostly they are equivalent to saying that people should not be overly concerned about the burning down of the world's only genetic library because the number of "books" in it is not known within an order of magnitude, and fire modelers disagree on whether it will be half consumed in a couple of decades or whether that level of destruction might take 50 years. Apparently a few scientists would never call the fire department unless they could inform it of the exact temperature of the flames at each point in a holocaust nor, similarly, would they recommend beach erosion control unless every grain of sand had been counted.

Many of the criticisms directed at the "doomsayers" look even sillier when one realizes that a major component of the decline of biodiversity is the loss of genetically distinct *populations*. Much of the public discussion of extinctions is concentrated on species for historical reasons, but extirpation of populations is the dominant element of the extinction crisis in temperate regions today and most severely threatens ecosystem services in those areas. To understand the critical necessity of preserving population diversity, one need only consider what would happen to ecosystem services globally if every species were reduced to a single population of, say, 200 individuals.

In short, the evidence of an impending catastrophic loss of biodiversity is already overwhelming, in spite of substantial (and unresolvable) uncertainties about exact rates of species loss. The most important scientific question remaining is the degree to which increasingly depauperate ecosystems in the future will be able to supply ecosystem services. That seems to be a question that much of humanity (including a few ecologists) is willing to have settled by a single vast irreversible experiment.

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## The Need for Mandatory Retirement for Tenured Faculty

The Age Discrimination in Employment Act (ADEA) forbids mandatory retirement on account of age; in its 1986 amendments there are certain exceptions, in particular one which allows colleges and universities to retain until 1994 retirement at age 70 for tenured faculty. This situation has been studied by Albert Rees and Sharon P. Smith (1) (Policy Forum, 23 Aug., p. 838), who mention the alarm of university administrators "who fear that the new law would force colleges and universities to retain faculty members who were no longer competent teachers or researchers." They conclude that this alarm "is not warranted," but their analysis makes no mention of and cites no measures of competence or quality in either teaching or research. Instead they emphasize "mean age at retirement" for a sample of institutions.

Rees and Smith use a sample that includes many institutions where retirement has been recently "uncapped." At those institutions, uncapping may have led older faculty members to stay on almost indefinitely; as they are not yet retired, they will not enter into that calculated mean age at retirement. Thus the immediate effect of uncapping is likely to be a decrease in the mean age of retirement. More information would be given by considering the percentage of faculty staying on beyond age 70.

The authors state that their sample is not intended to be random, for example, it contains no private research universities where retirement has been uncapped. They found only one such; this may suggest that, without political pressure, universities do not find uncapping retirement a wise course of action.

Rees and Smith say their "multiple regression analysis" identifies factors that "clearly explain . . . the variation in retirement age" (that is, the variation with type of institution). No regression analysis over selected variables can identify factors not fed into the analysis, and such analyses can be considerably distorted by the choice of factors. In this case, we do not know whether the right factors (for example, competence) have been chosen.

The authors also "project the age composition of the tenured faculty in the arts and sciences to the year 2004." "Projection" is a weasel word. Everything depends on the model used and on experience of how it may match reality. In the present case, the crystal ball is a model called "COHORT." Does this model include new retirement rules? No evidence of its effectiveness in prediction is offered. Instead we are told that it is a

"Markov chain model with feedback." We are not told what is fed back or where it is fed. In brief, the projection of age composition seems to be without support.

In the 1986 amendments to the ADEA, Congress requested the National Academy of Sciences to study the effects of ending mandatory retirement. The National Research Council (NRC) has now issued the requested report (2), which recommends that the ADEA exemption for tenured faculty be allowed to expire at the end of 1993. Here again the central issue should be (but is not) the effect on the quality of faculty in both teaching and research. In this 149-page report, teaching is discussed in exactly one page.

In discussing the cognitive abilities of faculty, the NRC report quotes specialists who have studied changes in cognitive scores with increasing age. However, the tests giving these scores are standard ones bearing on such things as "remembering an address" or "reasoning by analogy," so they may have little relation to the desired activity of faculty in providing inspiring teaching or cutting-edge research. One must therefore doubt the conclusion that "there would be little overall decrease in the mental activity of faculty for several years of continued employment past age 70." As yet there is no experience with activity or its absence under such employment.

Research performance is treated in the NRC report chiefly in terms of various counts of publications and citations; it is observed that such counts show a gradual decrease with age in the number of articles published. These numerical counts do not bear on the quality of research, or on the possibility that older faculty publish more potboilers. The report quotes unnamed faculty and administrators as saying, "Many faculty are able to make continuing contributions regardless of age." No explicit evidence is offered, and the general experience suggests that at least energy diminishes with age.

The importance of appointing younger faculty has long been clear. For example, an earlier NRC report (3), "Research excellence through the year 2000" stated

A serious impairment of the flow of qualified doctoral scientists and engineers into faculty positions would, we believe, seriously damage the vitality of both the research and the instructional components of the academic enterprise.

Uncapping retirement for tenured faculty has many effects—slower renewal of faculty, less attention to new fields of study, less energy for teaching, and faculty who hang on to build up their pensions, as well as added costs to the colleges and universities for possible performance evaluations and buyouts. Ending mandatory retirement on the basis of inadequate evidence and in the

face of the indicated results for colleges and universities is therefore a grave mistake. The ADEA act allows mandatory retirement for selected business executives with adequate pensions. The current revisions of ADEA should offer the same provision for tenured faculty.

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#### REFERENCES AND NOTES

1. A. Rees and S. P. Smith, *Faculty Retirement in the Arts and Sciences* (Princeton Univ. Press, Princeton, NJ, in press).
2. National Research Council, *Ending Mandatory Retirement for Tenured Faculty: The Consequences for Higher Education* (National Academy Press, Washington, DC, 1991).
3. National Research Council, *Research Excellence Through the Year 2000: The Importance of Maintaining a Flow of New Faculty into Academic Research* (Commission on Human Resources, National Research Council, Washington, DC, 1979).
4. Supported by a pension from TIAA-CREF.

**Response:** The most important of MacLane's complaints about our Policy Forum is that we presented no data on the effect of age on teaching or research performance. In our book (1), we devoted a full chapter to this crucial subject, but we were precluded from discussing it in the Policy Forum by space limitations. The effect of age on teaching performance as measured by student evaluations, although significant, is small and is not consistent in direction across disciplines or institutions. Teaching performance declines for instructors in the natural sciences in their 60s, but rises for the social sciences and is mixed for the humanities. Research productivity declines in all disciplines after middle age. Nevertheless, professors in their 60s publish on average more than one article a year, and many still receive research grants.

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#### REFERENCES

1. A. Rees and S. P. Smith, *Faculty Retirement in the Arts and Sciences* (Princeton Univ. Press, Princeton, NJ, in press).

Although the conclusions of Rees and Smith are probably valid, it is stretching credulity to believe that students' SAT scores affect faculty age at retirement. I am reminded of the example given in lectures on the misuse of statistics and correlations, namely, that the increase in the number of

telephone poles in the United States in the early 19th century was not the cause of the almost equal decline in the number of typhoid cases.

Incentive programs for early retirement are not always "very expensive, and . . . may not be worth [the] cost," as Rees and Smith state. For some institutions, the cost may be borne by the retirement system while the college budget reaps the benefit of getting replacement staff at lower initial salaries. This is certainly true for New York State and New York City higher educational systems.

Perhaps the best reason that faculty have for retirement (despite the right to continue working) is that they are sufficiently learned to do simple arithmetic. When adding up pension payments, social security benefits, and reduced income tax liability and subtracting this sum from current take-home pay, tenured faculty may clearly see that by continuing in their current position, they are working for less than the federal minimum wage. With this knowledge in hand, they opt for retirement. They may then accept positions in other institutions. Shouldn't Rees and Smith have considered this option in their analysis?

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#### Research on Animals: Unforeseen Benefits

Along with many other basic researchers, I believe that biomedical research requiring the use of animals is necessary and justified even when the practical long-term gains cannot be seen. There are those who support some animal research but say they can see no use for other work simply because the costs outweigh *foreseen* benefits. I could not disagree more.

In his book, *Newton's Madness* (1), a collection of stories based on some of his neurological cases, Harold Klawans recounts his conversation in Vienna with the Austrian neurologist who discovered that the administration of the substance L-dopa improves parkinsonism by being converted to dopamine that is lost with the degeneration of certain brain cells. That loss results in parkinsonism. Klawans, interested in the mechanisms of certain of L-dopa's side effects in humans, was studying the effects of large doses in guinea pigs at the time. His colleague suggested he look at another substance reduced in parkinsonism as well, serotonin. He called home to a medical student seeking a manageable research project for the summer and suggested she give some guinea pigs the precursor that is converted to serotonin in the brain. "What will happen, she

asked?" "I have no idea, he said, but let's see. That's research."

To make a long story short, the student found during that summer that the guinea pigs given the precursor bounced like heated kernels of popcorn and that the severity of bouncing was correlated with the degree of increase in brain serotonin. She suggested, tongue in cheek, that they had an animal model of popcorn but of nothing else. Klawans then found that the bouncing could be elicited by loud sounds, and there the matter rested—an animal model looking for a disease, as he put it.

Debra Marshall, "The girl with dancing eyes," came along 2 years later. Her eyes danced around along with other jerks that prevented her from walking. When crawling, she sometimes jumped off the floor—like a piece of popcorn. This gave Klawans an idea, for she also bounced when he clapped his hands. He had read of two conditions causing this in young children—a type of encephalitis and a tumor, called a neuroblastoma, located not necessarily in the brain but often in the chest. Because she did not act like a child with encephalitis, he bet on the tumor, thinking it might be secreting a substance like the serotonin precursor his student had given the guinea pigs a couple of years before. Sure enough, she had a chest neuroblastoma and went home cured after its removal.

The lesson is clear. The trained mind must be allowed to pursue research—humanely, but with as few impediments as possible. That mind's curiosity is enough, and exercising that mind will almost inevitably pay off. Certainly Debra Marshall's parents would agree with me. I intend to continue educational efforts directed at those untutored in biomedical science to assure them that our stand is justified.

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#### REFERENCES

1. H. Klawans, *Newton's Madness: Further Tales of Clinical Neurology* (Harper & Row, New York, 1990).

**Editor's Note:** The above letter was adapted from Dr. Morrison's statement of acceptance of the 1991 AAAS Scientific Freedom and Responsibility Award.

**Erratum:** In the Books Received column of 23 August (p. 920), the number of pages in *Selected Genetic Papers of J. B. S. Haldane* (K. R. Dronamraju, Ed., Garland, New York, 1990) was given incorrectly. The book has 542 pages of text. The current price of the book is \$120.

**Erratum:** In the heading of the book note describing *Tsunami Hazard* (Some Other Books of Interest, 20 Sept., p. 1431), the name of the publisher of the book was omitted. It is Kluwer Academic Publishers, 101 Philip Drive, Norwell, MA 02061.