Xu *et al.* contend that there is little democratic support for the NFCP from the people in the affected areas; however, we see the opposite. Development of the NFCP started in 1996 with the active involvement of forestry professionals, scholars, and local communities. It took 2 years for the central government to formulate the new forest policy. Forestry units from almost all provinces applied to participate in the NFCP. During implementation, the technical training and education program we discussed in our Policy Forum has been offering opportunities to hundreds and thousands of forestry professionals, nonprofessionals, and farmers to acquire government support and guidance and to negotiate with the policy practitioners.

Regarding the criticism that the NFCP does not incorporate current forest management approaches, ecosystem management and biodiversity principles have indeed been incorporated into classifying forest regions, prioritizing NFCP zones, and developing the new policy since it began. Only when the remaining natural forests are successfully protected can ecosystem management become practically meaningful. The central government has assigned one of the three major research sites we mentioned, Baihe Forestry Bureau in Jilin province, as a test site where forest cutting and regeneration for maintaining ecosystem sustainability are being studied. Certainly, as the policy is implemented and the trend in deforestation reversed, more sophisticated practices of ecosystem management will be specified for the next stage.

And as for the social and cultural impacts of relocating forest dwellers, extensive forest exploitation did not occur until the 1950s, when the government started to move thousands of people to forested areas. The native culture in forested areas has been severely affected along with forest. Relocating foresters who are non-natives is the only way to control human populations in forested areas and restore native culture and biodiversity. Educational and financial support provided by the government should adequately minimize the chances of major social conflicts during resettlement operation.

Guang Zhao
South Carolina Department of Health and Environmental Control, Columbia, SC 29201, USA. E-mail: ZHAOG@columb20.dhec.state.sc.us

Guofan Shao
Department of Forestry and Natural Resources, Purdue University, West Lafayette, IN 47907–1159, USA

Peichang Zhang
Center for Natural Forest Conservation and Management, State Forestry Administration, 18 Hepingli E., Beijing 100714, P. R. China

Guangxin Bai
Forest Administration Bureau of Yanbian Korean Nationality Autonomous Prefecture, 67 Henan Street, Yanji City, Jilin Province 133001, P. R. China

References and Notes

1. P. Zhang, X. Zhou, F. Wang, *Introduction to Natural Forest Conservation Program* (China's Forestry Publishing House, Beijing, 1999), p. 388 (in Chinese).
2. See information available at http://www.iisd.ca/forestry/forest.html
3. G. Shao and G. Zhao, in preparation.

Acceptable Evidence

Boyce Rensberger in his Essay "The nature of evidence" (*Science*'s Compass, 7 July, p. 61) makes a solid and hopeful case for improvements in science exposition in the popular media—particularly in regard to the training of journalists in what constitutes acceptable evidence from a scientific perspective. Certainly, much of the media could only benefit from such exposure; it is alarmingly common to see an utter suspension of evidentiary rules when reporting on extraordinary and often anecdotal hypotheses such as divining for water or therapeutic touch. The public is not well served by journalism that does not aggressively evaluate the quality of the evidence behind such claims.

Rensberger suggests that scientists make a greater effort to explain their methods to the press. However, many scientists themselves do not have a working grasp of defensible scientific method. Decades of mandatory instruction in statistics and experimental design to undergraduates and graduates in the life sciences have left multitudes of students, and not a few faculty, who still seek mostly confirmatory rather than contradictory evidence, who can't understand the concept of sampling distributions and hence do not understand the risks of small samples or lack of independent replication, who don't understand the most basic rules of probability that can severely affect the interpretation of evidence (such as independence or correlation of observations), and who have never grasped the concept of null distributions or that powerful tool of all skeptics—all data sets can be "explained" by multiple hypotheses. All over the country, life-science departments spend enormous effort teaching their students "things" rather than teaching them how to do science.

This critical deficiency in scientific training leads to the problem that Joshua Lederberg described in comments relating to scientific fraud: "The promulgation of fraud is an outrage, striking at the moral roots of the scientific enterprise. But its moral stridency is large, I submit, compared to its practical importance in most scientific fields. A much larger toll is exacted from inadequate experimental design and sloppy execution. The lost effort that is expended in straightening out muddy claims, or merely in plowing through their presentation in the literature, greatly exceeds what can be attributed to intentional fraud" (*1*, p. 13).

If anything, the situation Lederberg described has only become more muddied. We should be working hard to clean up both the science and its reporting.

Stephen M. Smith
Department of Biology, University of Waterloo, Waterloo, Ontario N0B 2L0, Canada

References

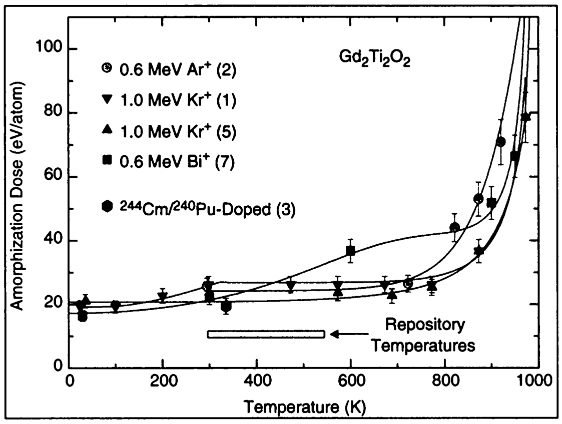
1. J. Lederberg, *Scientist* 9 (no. 4), 13 (1995).

Plutonium Immobilization and Radiation Effects

In their report "Radiation tolerance of complex oxides" (4 Aug., p. 748), Sickafus and colleagues note in the last paragraph "that compounds with the fluorite structure are especially stable in a displacive radiation damage environment," and they propose that complex oxides that have a fluorite structure (with respect to the arrangement of cations and anions in crystals), such as $Er_2Zr_2O_7$, have important applications in nuclear waste management. The most obvious application is plutonium immobilization.

We earlier proposed (*1*) the use of $Gd_2Zr_2O_7$ for plutonium immobilization on the basis of (i) the extremely high cross section of Gd for neutron absorption, which provides criticality safety, and (ii) our discovery that compositions in the gadolinium-zirconate system have the ability to resist radiation damage by energetic particles such as those from radioactive decay of plutonium. These Gd-Zr compounds absorb the energy through a rearrangement of Gd, Zr, and O atoms within the crystal structure without becoming amorphous or otherwise structurally unstable (*1, 2*).

The compound gadolinium titanate ($Gd_2Ti_2O_7$), the primary candidate phase for plutonium immobilization in government-sponsored studies in the United States, Russia, and Australia, is readily amorphized by alpha-decay damage (*3*). This amorphization causes swelling, cracking, and a 50-fold increase in the leach rate of plutonium (*3*). Studies of radiation effects over millions of years in natural titanates (*4*) show that amorphization occurs at a similar alpha-decay dose as that observed for $Gd_2Ti_2O_7$ (*3*). When heavy-ion irradiation is used to simulate alpha-decay effects, $Gd_2Ti_2O_7$ is found to amorphize at the same equivalent dose as for alpha-decay damage at ambient temperature, and high temperatures are required to prevent amorphization (*1, 5*) (see the figure). Heavy-ion irradiation also confirms that amorphization occurs directly in atomic collision cascades (*6*) and increases the aqueous leach rate by at least a factor of 10 (*7*).



The atomic-collision dose, energy dissipated per atom (eV/atom), required to amorphize $Gd_2Ti_2O_7$ as a function of temperature demonstrates the good agreement between the results of alpha-decay and heavy-ion experiments near 300 kelvin. Note the high temperatures that are required to inhibit amorphization compared with the repository temperature range.

CREDIT: W. J. WEBER AND R. C. EWING