LETTERS

edited by Jennifer Sills

Retraction

IN THE REPORT "DARWINIAN SELECTION ON A SELFING LOCUS" (*1*), WE CONCLUDED THAT A species-wide selective sweep was associated with the rise of selfing in *A. thaliana*. We have reinvestigated the sequence and structure of alleles at the *S* pseudo locus and now find that spurious PCR amplification by the primers and/or by DNA contaminations resulted in our report of the Ψ*SCR1* and Ψ*SCR2/3* sequence from the accessions with haplotype B (CS902 ecotype) and haplotype C (CS1044, CS6751, and CS6764 ecotypes). Instead, haplogroup C either does not have an *SCR* allele, or if it is present it is so divergent as to be undetectable by PCR or Southern blotting. In CS902, which has a haplotype group B at the *S* pseudolocus, we and other groups (*2*) have isolated a distinct and novel *SCR* allele. When these corrections are made to the data, the species-wide nature of the selective sweep can no longer be supported.

We have, however, conducted further experiments and reanalysis to characterize these alleles and resolved discrepancies with previous studies (*2*, *3*). We describe this reanalysis in a paper in the journal *Molecular Ecology* (*4*). In this paper, we report that Ψ*SCR1* and its derivative alleles spread to 94% frequency in a collection of 297 accessions. We conclude that a selective sweep did occur but was confined to European populations of *A. thaliana*, and that selfing appears to have evolved independently within this species. Moreover, our finding of three *SRK* haplotype groups, plus the very low diversity in the Ψ*SCR1* locus in most of the European accessions is still supported. Nevertheless, given that one of our previous conclusions is no longer tenable and in the interests of maintaining the integrity of the scientific literature, we retract the Report. Dr. Purugganan, as the senior author of the paper, takes full responsibility for these genotyping errors and apologizes for any difficulties it may have caused.

P. Awadalla (*1*) did not sign this Retraction because he does not support the interpretation of K.K.S. and M.D.P. above and thereafter (*4*) as sufficient evidence of a European sweep, and he was not involved in any data collection (*1*, *4*). However, he agrees that Shimizu *et al.* (*1*) should be retracted.

KENTARO K. SHIMIZU,[1] JENNIFER M. REININGA,[2]* ANA L. CAICEDO,[3] CHARLOTTE A. MAYS,[4] RICHARD C. MOORE,[5] KENNETH M. OLSEN,[6] STEPHANIE RUZSA,[4] GRAHAM COOP,[7] CARLOS D. BUSTAMANTE,[8] MICHAEL D. PURUGGANAN[9]

[1]Institute of Plant Biology, University of Zurich, Zurich, Switzerland. [2]Institute for Genome Sciences and Policy, Duke University, Durham, NC 27708, USA. [3]Department of Biology, University of Massachusetts, Amherst, MA 01003, USA. [4]Department of Genetics, North Carolina State University, Raleigh, NC 27695, USA. [5]Department of Botany, Miami University, Oxford, OH 45056, USA. [6]Department of Biology, Washington University, St. Louis, MO 63130, USA. [7]Department of Human Genetics, University of Chicago, Chicago, IL 60637, USA. [8]Department of Biological Statistics and Computational Biology, Cornell University, Ithaca, NY 14853, USA. [9]Department of Biology, New York University, New York, NY 10003, USA.

*In the 2004 Report, Jennifer M. Reininga's name was listed as Jennifer M. Cork.

References

1. K. K. Shimizu *et al.*, *Science* **306**, 2081 (2004).
2. C. Tang *et al.*, *Science* **317**, 1070 (2007).
3. S. Sherman-Broyles *et al.*, *Plant Cell* **19**, 94 (2007).
4. K. K. Shimizu, R. Shimizu-Inatsugi, T. Tsuchimatsu, M. D. Purugganan, *Mol. Ecol.* **17**, 704 (2008).

Vegetation's Role in Coastal Protection

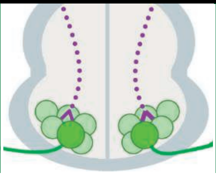
WE ARE CONCERNED ABOUT THE ASSERTION in the Report by E. B. Barbier *et al*. that vegetation reduces coastal damage during extreme events ("Coastal ecosystem–based management with nonlinear ecological functions and values," 18 January, p. 321). Although the intended point was that ecosystem services do not linearly scale with habitat size, the conclusions drawn from the chosen example of wave attenuation are speculative. Figure S1, A to F, shows wave attenuation curves that are typical, with or without vegetation on the surface.

Several other recent papers have also argued that vegetation reduces the impact of extreme events such as the Asian tsunami (*1*, *2*) or Hurricane Katrina (*3*, *4*). As in these studies, the evidence collected by Barbier *et al.* is based on correlation or visual description.

In the examples where vegetation appears to have protected the coast, there is no clarification as to the mechanism involved. It has been inductively proven that coastal plants can "engineer" land elevation (topography and bathymetry) through succession, but this is a long-term process that occurs before the event (e.g., the sand dune example in Barbier *et al.*). It has not yet been determined whether vegetation can resist waves over a few meters in height during an extreme event (*5*). Thus, an important question is whether vegetation structure reduces coastal damage directly through wave attenuation or indirectly by altering the geography of the landscape.

The difference has serious management and policy implications. If we emphasize direct structural value, we may end up with coastlines populated with invasive species or anthropogenic structures that kill more people than the waves themselves during extreme

CREDIT: JIM REED/CORBIS


No axon mingling allowed
185

Cells at high resolution
187

events (*6*, *7*). And we still cannot guarantee that the surge (the real killer) or erosion [often enhanced by attenuation (*8*)] will be reduced.

RUSTY A. FEAGIN

Spatial Sciences Laboratory, Department of Ecosystem Science and Management, Texas A&M University, College Station, TX 77845, USA, and Fitzwilliam College, University of Cambridge, Cambridge CB3 0DG, UK. E-mail: feaginr@tamu.edu

References

1. F. Danielsen *et al.*, *Science* **310**, 643 (2005).
2. E. B. Barbier, *Front Ecol. Env.* **4**, 124 (2006).
3. R. Costanza, W. J. Mitsch, J. W. Day Jr., *Front. Ecol. Env.* **4**, 465 (2006).
4. J. W. Day Jr. *et al.*, *Science* **315**, 1679 (2007).
5. I. Möller, *Estuarine Coast. Shelf Sci.* **69**, 337 (2006).
6. K. Kathiresan, N. Rajendran, *Estuarine Coast. Shelf Sci.* **65**, 601 (2005).
7. A. M. Kerr, A.H. Baird, *Bioscience* **57**, 102 (2007).
8. I. Möller, T. Spencer, *J. Coast. Res.* **SI36**, 506 (2002).

Response

FEAGIN RAISES AN EXCELLENT QUESTION, but misunderstands our findings on the wave attenuation function of key coastal interface systems. The wave attenuation shown in fig. S1A can be attributed nearly entirely to mangrove vegetation. As we explain in the Report's Supporting Online Material, this figure for attenuation of swells with 5- to 8-s periods on the Vietnam coast is based on a field study of a mangrove swamp with various tree sizes fronted by an intertidal shoal (*1*). Small outer mangroves had almost no effect on wave heights of 0.9 m, but passage through taller, denser mangroves inshore reduced wave height to between 0.05 and 0.1 m. The 90% reduction in wave height, as shown in fig. S1A, occurred across a wide tidal flat (gradient 0.5/1000 m) and is attributed to the extent and structure of the vegetation rather than to topographic changes (*1*). We show similar results for salt marshes, with wave height declining exponentially with the distance that the vegetation extends inland from the shoreline (fig. S1B).

Contrary to Feagin's assertion, we do not argue that the storm protection value of mangroves or any other coastal interface system relies solely on vegetation as a buffer against extreme events such as tsunamis or hurricanes; in fact, we suggest otherwise in our Supporting Online Material. We agree with Feagin that mangroves are unlikely to stop a tsunami wave larger than 6 m, as ecohydrological studies have shown (*2*–*5*). Wave attenuation by mangroves is "qualitatively different" for "large, infrequent disturbances" such as tsunamis, hurricanes (typhoons), and tidal bores, compared with "small, frequent disturbances" such as tropical storms, coastal floods, and tidal waves (*4*). Yet even with respect to extremely large events, such as the 2004 Indian Ocean tsunami, mangroves may act as natural barriers to some degree (*5*).

Finally, the storm protection value of mangroves used in our Report was estimated from 39 economically damaging coastal storm events from 1975 to 2004 affecting one or more of the 21 coastal provinces of Southern Thailand (*6*, *7*). Of these events, only four could be considered extreme storm events: three typhoons and the 2004 Indian Ocean tsunami. Moreover, the frequency of smaller storm events appears to be increasing; between 1975 and 1987, Thailand experienced on average 0.54 coastal natural disasters per year. Between 1987 and 2004, the incidence increased to 1.83 disasters per year (*6*). It is against these small, frequent, and economically damaging events that we are likely to see mangroves and other coastal interface habitats offer the greatest benefit in terms of storm protection, which tends to vary nonlinearly with habitat attributes.

EDWARD B. BARBIER,[1]* EVAMARIA W. KOCH,[2] BRIAN R. SILLIMAN,[3] SALLY D. HACKER,[4] ERIC WOLANSKI,[5] JURGENNE H. PRIMAVERA,[6] ELISE F. GRANEK,[7] STEPHEN POLASKY,[8] SHANKAR ASWANI,[9] LORI A. CRAMER,[10] DAVID M. STOMS,[11] CHRIS J. KENNEDY,[1] DAVID BAEL,[8] CARRIE V. KAPPEL,[12] GERARDO M. E. PERILLO,[13] DENISE J. REED[14]

[1]Department of Economics and Finance, University of Wyoming, Laramie, WY 82071, USA. [2]Horn Point Laboratory, University of Maryland Center for Environmental Science, Cambridge, MD 21613, USA. [3]Department of Zoology, University of Florida, Gainesville, FL 32611, USA. [4]Department of Zoology, 3029 Cordley Hall, Oregon State University, Corvallis, OR 97331, USA. [5]Australian Centre for Tropical Freshwater Research, James Cook University and Australian Institute of Marine Science, Townsville, QLD 4810, Australia. [6]Aquaculture Department, Southeast Asian Fisheries Development Center, Tigbauan, Iloilo 5021, Philippines. [7]Environmental Sciences and Resources, Portland State University, Portland, OR 97207, USA. [8]Department of Applied Economics, University of Minnesota, St. Paul, MN 55108, USA. [9]Department of Anthropology, University of California, Santa Barbara, CA 93106, USA. [10]Department of Sociology, Oregon State University, Corvallis, OR 97331, USA. [11]Bren School of Environmental Science and Management, University of California, Santa Barbara, CA 93106, USA. [12]National Center for Ecological Analysis and Synthesis, University of California, Santa Barbara, CA 93101, USA. [13]CONICET–Instituto Argentino de Oceanografia, Bahia Blanca, Argentina. [14]Department of Earth and Environmental Sciences, University of New Orleans, New Orleans, LA 70148, USA.

*To whom correspondence should be addressed. E-mail: ebarbier@uwyo.edu

References

1. Y. Mazda, M. Magi, M. Kogo, P. N. Hong, *Mangroves Salt Marshes* **1**, 127 (1997).
2. E. Wolanski, in *Coastal Protection in the Aftermath of the Indian Ocean Tsunami. What Role for Forests and Trees?* S. Braatz, S. Fortuna, J. Broadhead, R. Leslie, Eds. (FAO, Bangkok, 2007), pp. 157–179.
3. E. Wolanski, *Estuarine Ecohydrol.* (Elsevier, Amsterdam, 2007).
4. D. Alongi, *Estuarine Coast. Shelf Sci.* **76**, 1 (2008).
5. R. Cochard *et al.*, *Perspect. Plant Ecol. Evol. Syst.* **10**, 2 (2008).
6. E. Barbier, *Econ. Pol.* **22**, 177 (2007).
7. EM-DAT, *EM-DAT: The OFDA/CRED International Disaster Database* (Université Catholique de Louvain, Brussels, 2005); www.emdat.be.

A Quaternary Question

IN THE NEWS FOCUS BY R. A. KERR ("A TIME war over the period we live in," 25 January, p. 402), stratigraphers wish to rid the geological time scale of the Quaternary, on the grounds that "boundaries on the time scale are not delineated by climate changes." How very odd, then, that the end of the Pleistocene—a unit that stratigraphers are happy to keep—is defined by their governing body, the International Commission on Stratigraphy, as "Exactly 10,000 Carbon-14 years BP. Near the end of the Younger Dryas cold spell" (*1*). So, a chronologically arbitrary round number tied to the end of a merely millennium-long cold snap is somehow acceptable as a geological unit, but the climatically bounded Quaternary is not? What am I missing?

DAVID J. MELTZER

Department of Anthropology, Southern Methodist University, Dallas, TX 75275–0336, USA.

Reference

1. www.stratigraphy.org/geowhen/stages/Pleistocene.html

Response

THE INTERNATIONAL UNION FOR QUATERnary Research (INQUA) Commission on Stratigraphy determined at the 1969 INQUA Congress in Paris that the Holocene should be delineated as "exactly 10,000 Carbon-14 years BP," as correctly stated by Metzer. However, this is not a definition but a duration of a chronostratigraphic unit. A true definition of a chronostratigraphic boundary includes (i) a unique physical point in a stratigraphic section and (ii) supporting criteria by which the boundary can be identified. No definition was created for the base Holocene at the 1969 INQUA Congress. In fact, little was done regarding this unit for nearly 40 years! A Working Group of the current ICS Subcommission on Stratigraphy (*1*) is in the process of writing a definition of the base Holocene that includes an archived core to serve as the unique physical point, as well as criteria such as values for deuterium excess, $\delta^{18}O$, dust concentration, a range of chemical species, and annual layer thickness. The Report of the Working Group is expected to be completed within 1 to 2 months and circulated for approval. Thus, the base Holocene will soon have a clear definition.

With regard to the "climatically bounded Quaternary," I would point out that the boundary of the Quaternary is currently under discussion by the Quaternary Subcommission on Stratigraphy and the Neogene Subcommission on Stratigraphy (*2*). The latter group prefers that the base Quaternary and base Pleistocene continue to be defined by the physical marker for the base Pleistocene. Quaternarists advocate the lowering of the base Quaternary (and base Pleistocene) to the physical marker of the (upper Pliocene) Gelasian Stage. These issues will be discussed at the International Geological Congress in Oslo in August 2008.

WILLIAM A. BERGGREN

Department of Geology and Geophysics, Woods Hole Oceanographic Institute, Woods Hole, MA 02543, USA.

References and Notes

1. P. Gibbard, *Annual Report of the Subcommission on Quaternary Stratigraphy*, in the *ICS Annual Report for 2007* (www.stratigraphy.org/report07.pdf).
2. Follow link to Global Boundary Stratotype Sections and Points at www.stratigraphy.org/.
3. I thank S. Finney for pointing me in the right direction for an update on the Holocene issue.

Letters to the Editor

Letters (~300 words) discuss material published in *Science* in the previous 3 months or issues of general interest. They can be submitted through the Web (www.submit2science.org) or by regular mail (1200 New York Ave., NW, Washington, DC 20005, USA). Letters are not acknowledged upon receipt, nor are authors generally consulted before publication. Whether published in full or in part, letters are subject to editing for clarity and space.

Soil Erosion: Data Say C Sink

IN THE LETTER "SOIL EROSION: A CARBON sink or source?" (R. Lal and D. Pimentel, 22 February, p. 1040) and in its Response (K. Van Oost *et al.*, 22 February, p. 1042), the authors note that soil erosion is a serious threat to land health. Nevertheless, evidence points toward a carbon (C) sink term induced by erosion. Mechanistically, accelerated soil erosion reduces the C source term because there is less C to decompose at the eroded site. Although erosion may reduce productivity (as discussed by Lal and Pimentel), any plant production, whether reduced or fertilized, contributes to C uptake (causing a sink), which can be quite high even in nonfertilized settings (*1*). As we attempt to account for transported C and its fate in depositional settings, we must consider larger temporal and spatial scales, whether colluvial (*2*–*4*), impoundment (*4*), or export to the ocean (*5*). This scaling requires careful accounting (*6*, *7*), in part because CO_2 exchange is dominated by large flux terms for plant and microbial processes (*8*) and in part because erosion events are highly episodic in time and discontinuous in space.

To make the accounting more tractable, Van Oost *et al*. used baselines in time (1953 from ^{137}Cs) and space (uneroded or unperturbed landscapes). Although Lal and Pimentel claim that the budget does not reflect (i) reduced productivity of eroded lands or (ii) a full accounting of C in transport and redeposition, in fact, the data were grounded with baseline controls that confirmed the sink term noted by other investigators.

Indeed, the relationship between C removed (by erosion) and C replaced (by plant production) suggests that ~25% (of eroded C) was replaced over the 50-year period, although much more C may be fixed by new photosynthate without persisting in soil (*1*). End members for C replacement are particularly interesting: Some soils and their C pools are more resilient to disturbance, perhaps owing to larger nutrient, water, and biotic capacities. Although the study by Van Oost and colleagues concluded that a relatively small C sink (globally ~0.1 Pg C per year) resulted from cropland erosion over recent decades, additional terms for (i) stimulating plant production in depositional areas (*4*) and (ii) including other extensive human-altered landscapes (such as those that are deforested or urbanized) must now be evaluated and are likely to indicate a somewhat larger global C sink from enhanced erosion.

JENNIFER W. HARDEN,[1] ASMERET ASEFAW BERHE,[2] MARGARET TORN,[3] JOHN HARTE,[2] S. LIU,[4] R. F. STALLARD[5]

[1]U.S. Geological Survey, Menlo Park, CA 94025, USA. [2]Division of Ecosystem Sciences, University of California, Berkeley, CA 94720, USA. [3]Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA. [4]SAIC, contractor to U.S. Geological Survey Earth Resources Observation and Science Center, Sioux Falls, SD 57198, USA. [5]U.S. Geological Survey, Boulder, CO 80303, USA.

References

1. A. A. Berhe, J. Harte, J. W. Harden, M. S. Torn, *BioScience* **57**, 337 (2007).
2. J. W. Harden *et al.*, *Global Biogeochem. Cyc.* **13**, 885 (1999).
3. S. G. Liu, N. Bliss, E. Sundquist, T. G. Huntington, *Global Biogeochem. Cyc.* **17**, 1074 (2003).
4. R. F. Stallard, *Global Biogeochem. Cyc.* **12**, 231 (1998).
5. E. T. Sundquist, *Science* **259**, 934 (1993).
6. J. T. Randerson, F. S. Chapin, J. W. Harden, J. C. Neff, M. E. Harmon, *Ecol. Appl.* **12**, 937 (2002).
7. F. S. Chapin III *et al.*, *Ecosystems* **9**, 1041 (2005).
8. S. E. Trumbore, *Global Change Biol.* **12**, 141 (2006).

CORRECTIONS AND CLARIFICATIONS

Reports: "Ceramide triggers budding of exosome vesicles into multivesicular endosomes" by K. Trajkovic *et al*. (29 February, p. 1244). Two papers on ESCRT-independent transport should have been cited on page 1245. The text beginning "the pathway for intraendosomal transport of PLP may be ESCRT-independent" should continue "similar to the transport of Pmel17 into melanosomes" and cite A. C. Theos *et al*., *Dev. Cell* **10**, 343 (2006). The text beginning "the release of CD63 (with enhanced GFP fusion, EGFP-CD63) was not affected by coexpression with dominant-negative Vps4 (fig. S9)" should continue "as shown previously" and cite Y. Fang *et al*., *PLoS Biol*. **5**, e158 (2007).

Reports: "The premetazoan ancestry of cadherins" by M. Abedin and N. King (15 February, p. 946). Values in Table 1 for normalized cadherin abundance were changed in error. The correct percentages are as follows: for the choanoflagellate *Mbre*, 0.25; for *Nvec*, 0.26; for *Dmel*, 0.12.

Association Affairs: "Science and technology for sustainable well-being" by J. P. Holdren (25 January, p. 424). In Table 4, the heading reading "Primary energy (terawatt-hours)" should have read "Net electricity (terawatt-hours)." In ref. 73, the positions held by G. Schultz, H. Kissinger, W. Perry, and S. Nunn were incorrectly described. The text should have read "Schultz and Kissinger served as U.S. secretary of state, Perry was secretary of defense, and Nunn was chair of the Senate Armed Services Committee."