LETTERS

edited by Jennifer Sills

Old Trees: Extraction, Conservation Can Coexist

BECAUSE LARGE OLD TREES ARE ESSENTIAL FOR FOREST ECOSYSTEM INTEGRITY AND BIODIVERSITY, timber extraction in managed forests should preferentially be concentrated where large old trees are least likely to develop ("Global decline in large old trees," D. B. Lindenmayer *et al*., Perspectives, 7 December 2012, p. 1305). However, timber extraction and the conservation of large old trees are not necessarily mutually exclusive.

Current forest policy and management practices in Flanders, Belgium, aim to convert even-aged stands (areas in which trees are all the same age) to stands with trees of varying ages in an effort to increase forest ecosystem stability and resilience and to allow trees to grow old. As part of their ecologically sustainable forest management, public forest managers have adopted a large-tree retention approach [see also (*1*, *2*)]. Tree islands within stands managed for production of high-quality timber are reserved for conservation, and trees within these islands will never be extracted. Large old trees of commercially valuable species that have grown beyond the commercially optimal dimensions will not be logged either. And no tree beyond a threshold diameter [currently set at dbh (diameter at breast height) of more than 102 cm] will ever be logged. The strip-shelterwood system (in which trees are cut in linear strips and surrounding trees are given time to grow old) and the coppice-with-standards system (in which some trees are left to grow while others around them are cut) are two examples of forest management that allows the combination of sustainable forest exploitation and conservation of large old trees.

RAF AERTS

Division Forest, Nature and Landscape, University of Leuven, Celestijnenlaan 200E-2411, BE-3001 Leuven, Belgium. E-mail: raf.aerts@biw.kuleuven.be

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CREDIT: GRZEGORZ MIKUSINSKI

Old Trees: Cultural Value

AS D. B. LINDENMAYER *ET AL.* POINT OUT ("Global decline in large old trees," Perspectives, 7 December 2012, p. 1305), large old trees play a key ecological role in many different environments, and their observed decline may have disastrous consequences for biodiversity and ecosystem integrity. However, the value of large trees as part of our cultural heritage, often neglected in conservation, may be essential for addressing the problem of their global decline.

Old trees span several human generations and thereby constitute a living link between them. Cultural, religious, spiritual, and symbolic values of the large trees, as well as indigenous communities' reliance on services provided by them, provide a firm foundation for practical conservation. In many cases, the general society's preferences concerning large trees may coincide with the broad conservation interest (*1*).

Moreover, large trees wake emotions, appeal to our aesthetic sentiments, and are often perceived as important landmarks. In this sense, they may be perfect flagship elements of the conservation strategies. For example, a concern for big trees in the beginning of the 20th century led to action that safeguarded the future of giant sequoias, perceived as "natural temples" (*2*). When considering a multitude of large trees' virtues, it seems that the value of these iconic organisms should be more broadly recognized by the conservation community, as it may support their conservation goals.

MALGORZATA BLICHARSKA[1]* AND GRZEGORZ MIKUSINSKI[2]

[1]Department of Aquatic Sciences and Assessment, Swedish University of Agricultural Sciences, 750 07 Uppsala, Sweden. [2]School for Forest Management, Swedish University of Agricultural Sciences, 739 21 Skinnskatteberg, Sweden.

*To whom correspondence should be addressed. E-mail: Malgorzata.Blicharska@slu.se

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Old Trees: Large and Small

D. B. LINDENMAYER *ET AL.* ("Global decline in large old trees," Perspectives, 7 December 2012, p. 1305), report a global decline in large old trees and show that climate change and human disturbance are reducing the abundance of these ecologically important organisms. Such framing of the problem leads to conflation of two issues: Old trees and large trees are not synonymous.

While the term "old growth" brings to mind the iconic sequoias described by the authors, stunted and slow-growing forests in extreme environments also play important ecological roles, and declines in small old trees are of increasing concern. Landscapes with small old trees (often surviving at the edge of their ranges) function as genetic repositories and population refugia, which play a critical role in the long-term persistence of forest ecosystems (*1*, *2*).

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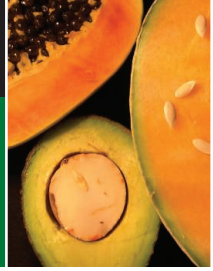

Cryopreservation of plant diversity

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IBI Prize Essay

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In southern Brazilian Atlantic forests, where highly diverse isolated populations can persist over several millennia, small old trees have shown recent growth decline (*3*). Here, at the southernmost limit of tropical forest distribution, trees more than 40 cm in diameter are rare, and landscapes dominated by small trees provide essential services, but very little of the original forest cover is protected by nature reserves. A hemisphere away, in northern Ontario, Canada, live some of the largest undisturbed old-growth pine forests in North America (*4*). Recent work suggests that here, too, the growth of small old trees (typically less than 50 cm in diameter, from 150 to more than 300 years) has been declining (*5*). As climatic changes and human demands increase, widespread growth declines and increased mortality threaten global forests (*6*–*8*). The struggles of large old trees are important, but they are by no means unique.

JACOB CECILE,[1] LUCAS R. SILVA,[2] MADHUR ANAND[1]*

[1]Global Ecological Change and Sustainability Laboratory, School of Environmental Sciences, University of Guelph, Guelph, ON, N1G 2W1, Canada. [2]Department of Land, Air, and Water Resources, University of California Davis, Davis, CA 95616, USA.

*To whom correspondence should be addressed. E-mail: manand@uoguelph.ca

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Response

CECILE *ET AL.* TAKE ISSUE WITH OUR RECENT Perspective on the rapid global decline of large old trees by asserting that "large" and "old" are not synonymous. Of course, some ancient trees are indeed short in stature [e.g., (*1*)]. Nonetheless, many of the world's largest trees are also old (more than 500 to 1000 years) (*2*, *3*), so it is correct to highlight this reality.

Cecile *et al*. further argue that small old trees are declining in some ecosystems, and we agree that this is a matter of concern. However, large old trees are particularly vulnerable to disturbances such as insect attack, pathogens, drought, and fire in some environments (*4*–*6*). Large old trees also play a range of key roles (e.g., as wildlife habitat and for carbon storage) that are not played by small old trees. Unlike large old trees, small old trees are rarely deliberately removed during agricultural intensification (*7*) or because of safety concerns in urban environments (*4*). In addition, small old trees are less likely to be targeted for logging [although they may be specifically targeted in some restoration projects in western North America because of prohibitions on removal of larger trees (*8*)]. The particular risks faced by large old trees, combined with their unique ecological roles, mean that their management and conservation warrant special mention.

DAVID B. LINDENMAYER,[1]* WILLIAM F. LAURANCE,[2] JERRY F. FRANKLIN[3]

[1]Fenner School of Environment and Society, The Australian National University, Canberra, ACT 0200, Australia. [2]Centre for Tropical Environmental and Sustainability Science (TESS), and School of Marine and Tropical Biology, James Cook University, Cairns, QLD 4878, Australia. [3]School of Environmental and Forest Science, University of Washington, Seattle, WA 98195, USA.

*To whom correspondence should be addressed. E-mail: david.lindenmayer@anu.edu.au

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Letters to the Editor

Letters (~300 words) discuss material published in *Science* in the past 3 months or matters of general interest. Letters are not acknowledged upon receipt. Whether published in full or in part, Letters are subject to editing for clarity and space. Letters submitted, published, or posted elsewhere, in print or online, will be disqualified. To submit a Letter, go to www.submit2science.org.

China's Little Emperors Show Signs of Success

IN THE REPORT "LITTLE EMPERORS: BEHAVIOR impacts of China's one-child policy" (22 February, p. 953; published online 10 January), L. Cameron *et al*. suggest that being an only child as a result of China's one-child policy (OCP) might carry negative implications for success and well-being. We caution against overgeneralization from the economic experiments and personality surveys conducted in this study.

In longitudinal studies among the first post-OCP cohort—the same cohort as that studied by Cameron *et al*.—some singletons showed more behavioral problems and less independence in childhood. Yet, by adolescence, differences in behavioral problems disappeared and independence levels reversed (*1*, *2*). In contrast to the experimental context, more pro-social behaviors among singletons than non-singletons were found in community samples (*2*). In education, singletons performed as well as or better than their peers in verbal and math skills and showed better school adjustment and lower levels of anxiety, but they demonstrated inferior testing and study methods (*3*, *4*). Once they became parents, this cohort of singletons showed no difference in marriage adjustment compared with their counterparts, and in fact demonstrated higher levels of life satisfaction and higher intergenerational family fusion (*5*). Contrary to the hypothesis that maladjustment might be magnified in later post-OCP cohorts, singletons born in the 1990s have shown equal or superior interpersonal relationships with peers, teachers, and family members compared with non-singletons (*6*).

All this is not to deny legitimate concern over the OCP, only-child status, or the combination of both. Yet, against expectation and stereotype, research has shown that as "little emperors" transition into adulthood, their well-being and performance are comparable with, if not superior to, those with one or more siblings. In such complex systems as that of human psychology and behavior, one must move beyond linear notions of causality. Circular processes of self-correction at the individual, family, and social levels often provide surprising compensatory responses to initial conditions.

XUDONG ZHAO,[1] XIQUAN MA,[1] YUHONG YAO,[2] CHONGHUA WAN,[3] EMILY NG[4]*

[1]Shanghai East Hospital; Department of Psychosomatic Medicine, School of Medicine at Tongji University, Shanghai, China. [2]Psychological Counseling and Education Center, Tongji University, Shanghai, China. [3]School of Humanities and Management, Guangdong Medical College, Dongguan, China. [4]Department of Anthropology, University of California, Berkeley, Berkeley, CA 94720, USA.

*To whom correspondence should be addressed. E-mail: emily.ng@berkeley.edu

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CORRECTIONS AND CLARIFICATIONS

This Week in *Science*: "Proton still too small" (25 January, p. 371). The study examined muonic hydrogen, not muonium. Muonic hydrogen is the name given to a system made from a proton and a negative muon. Muonium is the exotic atom made from a positive muon and a (negative) electron. The HTML and PDF versions online have been corrected.

News Focus: "The children's study: Unmet promises" by J. Kaiser (11 January, p. 133). The January 2013 workshop to review the study plan described in the text and timeline was sponsored by the National Academy of Sciences, not the Institute of Medicine. The HTML and PDF versions online have been corrected.

Letters: "NextGen speaks" (4 January, p. 30). Ali Jawaid's essay referred to Pakistan, not Switzerland. Jiang Zhao is at Beihang University, not Beijing University. Guilherme Martins Santos's address should be Laboratory of Molecular Pharmacology, Department of Pharmaceutical Sciences, Faculty of Health Sciences, University of Brasília, Brazil, CEP 70910-900, Brazil. In the online-only essays, Homare Yamahachi's essay referred to Greece, not Norway. These changes have been made in the HTML and PDF versions online.

Reviews: "Conversion of wastes into bioelectricity and chemicals by using microbial electrochemical technologies," by B. E. Logan and K. Rabaey (10 August 2012, p. 686). In the Fig. 2 legend, the symbols should have been identified as follows: "There is roughly an inverse relationship between the value of these products (circles) and the current densities (triangles)...." On p. 689, "4.5 a.m.$^{-2}$" should have been written as "4.5 A m^{-2}." The authors also wish to thank T. Lacoere and J. Desloover for assistance in preparing the draft figures and funding from the Commonwealth Scientific and Industrial Research Organization Flagship cluster "Biotechnological solutions to Australia's transport energy and greenhouse gas challenges." The HTML version online has been corrected.

TECHNICAL COMMENT ABSTRACTS

Comment on "Bilaterian Burrows and Grazing Behavior at >585 Million Years Ago"

Claudio Gaucher, Daniel G. Poiré, Jorge Bossi, Leda Sánchez Bettucci, Ángeles Beri

Pecoits *et al.* (Reports, 29 June 2012, p. 1693) describe bilaterian trace fossils and assign them an Ediacaran age based on the age of a granite interpreted as intrusive. We argue that the granite is not intrusive but in fact represents the basement of the sedimentary succession. Moreover, we show that identical trace fossils occur in nearby Carboniferous-Permian glacigenic rocks.

Full text at http://dx.doi.org/10.1126/science.1230339

Response to Comment on "Bilaterian Burrows and Grazing Behavior at >585 Million Years Ago"

Ernesto Pecoits, Kurt O. Konhauser, Natalie R. Aubet, Larry M. Heaman, Gerardo Veroslavsky, Richard Stern, Murray K. Gingras

Gaucher *et al.* suggest that their field observations and petrographic analysis of one thin section do not support an Ediacaran age for the trace fossils–bearing strata of the Tacuarí Formation. We have strengthened our conclusion of an Ediacaran age for the Tacuarí Formation based on reassessment of new and previously presented field and petrographic evidence.

Full text at http://dx.doi.org/10.1126/science.1230677