A World Without Mangroves?

AT A MEETING OF WORLD MANGROVE EXPERTS HELD LAST YEAR IN
Australia, it was unanimously agreed that we face the prospect of a
world deprived of the services offered by mangrove ecosystems, per-
haps within the next 100 years.

Mangrove forests once covered more than 200,000 km² of shel-
tered tropical and subtropical coastlines (1). They are disappearing
worldwide by 1 to 2% per year, a rate greater than or equal to declines
in adjacent coral reefs or tropical rainforests (2–5). Losses are occur-
tional diversity, particularly in species-poor systems like mangroves,
which have low redundancy per se (8). Therefore, any further decline
in mangrove area is likely to be followed by accelerated functional
losses. Mangroves are already critically endangered or approaching
extinction in 26 out of the 120 countries having mangroves (2, 9).

Deforestation of mangrove forests, which have extraordinarily high
rates of primary productivity (3), reduces their dual capacity to be both
an atmospheric CO₂ sink (10) and an essential source of oceanic car-
bon. The support that mangrove ecosystems provide for terrestrial as
well as marine food webs would be lost, adversely affecting, for exam-
ple, fisheries (11). The decline further imperils mangrove-dependent
fauna with their complex habitat linkages, as well as physical
benefits like the buffering of seagrass beds and coral
reefs against the impacts of river-borne siltation, or protec-
tion of coastal communities from sea-level rise, storm
surges, and tsunamis (12, 13). Human communities living
in or near mangroves would lose access to sources of essen-
tial food, fibers, timber, chemicals, and medicines (14).

We are greatly concerned that the full implications of
mangrove loss for humankind are not fully appreciated.
Growing pressures of urban and industrial developments
along coastlines, combined with climate change and sea-
level rise, urge the need to conserve, protect, and restore
tidal wetlands (11, 13). Effective governance structures,
socioeconomic risk policies, and education strategies (15)
are needed now to enable societies around the world to
reverse the trend of mangrove loss and ensure that future
generations enjoy the ecosystem services provided by such
valuable natural ecosystems.

N. C. DUKE,1 4 J.-O. MEYNECKE,2 S. DITTMANN,3 A. M. ELLISON,4
K. ANGER,5 U. BERGER,6 S. CANNICCI,7 K. DIELE,9 K. C. EWEL,9
C. D. FIELD,10 N. KOEDAM,12 S. Y. LEE,2 C. MARCHAND,12
I. NORDHAUS,8 F. DAHDOUH-GUEBAS13

1Centre for Marine Studies, University of Queensland, St Lucia, Qld 4072, Australia.
2Australian Rivers Institute and School of Environment, PMB 50 GCMC, Griffith University,
Qld 9726, Australia. 3School of Biological Sciences, Flinders University, GPO Box 2100,
Adelaide, SA 5001, Australia. 4Harvard University, Harvard Forest, 324 North Main Street,
Petersham, MA 01366, USA. 5Alfred-Wegener-Institut für Polar- und Meeresforschung,
Kruppmaden, D-27498 Helgoland, Germany. 6Technical University Dresden, Institut für
Waldwachstum und Forstliche Informatik, Postfach 1117 01735 Tharandt, Germany.
7Dipartimento di Biologia Animale e Genetica "Lea Pardi," Università degli Studi di Firenze,
Via Romana, 17, I-50125 Firenze, Italy. 8Center for Tropical Marine Ecology,
Fahrenheitstrasse 6, 28359 Bremen, Germany. 9U.S. Department of Agriculture Forest
Service, 2126 NW 7th Lane, Gainesville, Fl 32603, USA. 10Faculty of Science (Gore Hill),
University of Technology, Sydney, Post Office Box 123, Broadway NSW 2007, Australia.
11Laboratory of General Botany and Nature Management, Mangrove Management Group,
Vrije Universiteit Brussel, Pleinlaan 2, B-1050 Brussels, Belgium. 12LGPMC, EA 3325,
University of New Caledonia, Noumea, New Caledonia, and UR 103, Institut de Recherche
pour le Développement (IRD), Marseille, France. 13Biocomplexity Research Focus, c/o
Laboratory of General Botany and Nature Management, Mangrove Management Group,
Vrije Universiteit Brussel, Pleinlaan 2, B-1050 Brussels, Belgium.
integrality, plagiarism, etc.).

Most importantly, the undergraduate publication experience gives students an early introduction to the world of peer review, a cornerstone of science. For JYI, a student-led journal, this benefit is doubly advantageous. Not only do student authors benefit from peer review, our JYI student reviewers are also trained in the art of reviewing, a skill not given much emphasis in undergraduate research.

JYI has been at the forefront of such undergraduate peer review and publication for 10 years since its inception in 1997. From over 500 submissions, we have published 120 undergraduate research articles. Our highlights for the past year include several special issues devoted to publishing research articles of various universities’ Research Experiences for Undergraduates program, and participation in the recent 2007 AAAS Meeting, during which we hosted a workshop for science writing.

Our aim is to see science writing and communication play a central role in the undergraduate research experience.

Farhan Ali, Nafisa M. Jadavji, Willie Chuin Hong Ong, Kaushal Raj Pandey, Alexander Nikolić Patananan, Harsha Kiran Prabhala, Christine Hong-Ting Yang

Department of Psychology, National University of Singapore, Singapore. 1Department of Neuroscience, Canadian Center for Behavioural Neuroscience, Lethbridge, AC 11K 3M4, Canada. 2Optical Materials and Systems Division, D51 Building, Data Storage Institute, 5 Engineering Drive 1, Singapore, 117608. 3Department of Medicine, Tripuniv, Kathmandu, POB No 1524, Nepal. 4Department of Microbiology, Immunology, and Molecular Genetics, University of California at Los Angeles, Los Angeles, CA 90095, USA. 5Department of Biomedical Engineering, Johns Hopkins University, Baltimore, MD 21218, USA. 6Department of Human Biology, Stanford University, Stanford, CA 94305, USA.

Isoprene, Cloud Droplets, and Phytoplankton

There is an error that may invalidate the main conclusion of the Research Article “Phytoplankton and cloudiness in the Southern Ocean” by N. Meskhidze and A. Nenes (1 Dec. 2006, p. 1419). The authors report an increase in cloud reflectivity resulting from a 30% decrease in cloud droplet effective radius and a doubling of cloud droplet number concentration over a large phytoplankton bloom in the Southern Ocean, resulting in an extra 15 W m⁻² of energy reflected back to space. They attribute these changes to enhanced isoprene produced in the bloom. Our measurements made during the Southern Ocean Iron Experiments (SOFeX) (1) were used by Meskhidze and Nenes to scale seawater isoprene values based on measured chlorophyll-a concentrations. Unfortunately, they converted our isoprene concentrations incorrectly, resulting in a three-order-of-magnitude overestimation and hence a much greater calculated isoprene flux.

During SOFeX, we measured climate-relevant organic gases in the dynamic headspace of an equilibrator (2) in contact with seawater (1). We reported isoprene concentrations to be on average 560 pptv (parts per trillion by volume or picomoles mole⁻¹ of air) inside of the SOFeX North Patch (NP), which is the mixing ratio that the air above the water would have if the headspace were static. To convert from mixing ratio of static headspace to seawater concentration, we use Henry’s Law:

\[ C_a \cdot K_{H} = C_g \]  

where \( C_g \) is the mixing ratio of a gas in equilibrium with the dissolved gas in the aqueous phase, \( C_a \). An average Henry’s law constant \( K_{H} \) for isoprene of 0.0130 M atm⁻¹ was used (3). Therefore, the average seawater isoprene concentration in the NP was ~7.3 picomoles L⁻¹ (pm). Listed in the authors’ Table 2 is an average isoprene concentration of 31.4 nanomoles L⁻¹ (nM) in the NP This leads me to believe that isoprene is not the reason for their observed extra cloud albedo.

Oliver W. Wingenter

New Mexico Institute of Mining and Technology, Socorro, NM 87801, USA.
centrations but mixing ratios in the head-space of an equilibrator. When corrected, the values of $C_b^0$ in Table 2 should be reduced by about three orders of magnitude (see correction on page 43). This does not, however, alter our conclusions or isoprene secondary organic aerosol (SOA) hypothesis. The fact remains that reported isoprene air-sea fluxes and concentrations in the marine boundary layer (MBL) vary by orders of magnitude, with the average concentrations between 4 and $250$ pptv and fluxes of $10^{-6}$ to $6 	imes 10^{-3}$ molecules cm$^{-2}$ s$^{-1}$ (2–6). For the high end of measured isoprene levels in the Southern Ocean—which are attributed to enhanced phytoplankton productivity (5), our simulations suggest that the amount of SOA is potentially enough to impact cloud droplet number concentrations. This large range may be from highly variable environmental conditions [i.e., photosynthetically active radiation (PAR), sea-surface temperature, wind speed, ocean mixed-layer depth, etc.] and phytoplankton speciation encountered during the experiments. Given the above and the uncertainty in isoprene-to-SOA yield, to state that “isoprene is not the reason for their observed extra cloud albedo” implies a level of understanding that currently does not exist.

We have shown a direct and strong link between phytoplankton and clouds. Given the identified potential of ocean-emitted isoprene (and other volatile organic compounds) on atmospheric oxidizing capacity and new-particle formation (4–7), the possibility of isoprene SOA contributing to the global CCN budget is real and worth exploring.

**CORRECTIONS AND CLARIFICATIONS**

**Perspectives:** “Reassessing carbon sinks” by D. F. Baker (22 June, p. 1708). The summary sentence is incorrect. It should read, “Less carbon dioxide is taken up by the Southern Ocean, and more by tropical land areas, than previously thought.”

**Perspectives:** “Recent progress and continuing puzzles in electrostatics” by L. B. Schein (15 June, p. 1572). The summary sentence is incorrect. It should read, “Insight into the adhesion of charged insulating particles is affecting laser printing technology and may have other industrial applications.” In the figure caption, “200-µm” should read “300-µm.”

**Policy Forum:** “Danger of deep-sea mining” by J. Halfar and R. M. Fujita (18 May, p. 987). The deep-sea mining activities were erroneously described as strip-mining operations. The correct term should be pit-mining operations, implying an absence of overburden, as stated later in the article.

**Perspectives:** “A promising mimic of hydrogenase activity” by T. B. Rauchfuss (27 April, p. 553). The Perspectives state that the compound discovered by S. Ogo et al. [Science 316, 585 (2007)] catalyzes the hydrogenation of benzaldehyde to the corresponding alcohol. This statement referred to a preliminary result that was not presented in the published paper.

**References**


**REPORTS**

“The phosphothreonine lyase activity of a bacterial type III effector family” by H. Li et al. (16 Feb., p. 1000). A production error caused some of the data labels in Fig. 3C to be obscured. A corrected version appears below on the left.

**Address:** “Phytoplankton and cloudiness in the Southern Ocean” by N. Meskhidze et al. [Chl a, fluxes, and atmospheric concentrations of isoprene (10$^3$ molecules cm$^{-2}$ s$^{-1}$)]

**Average**

<table>
<thead>
<tr>
<th>Average</th>
<th>Bloom</th>
<th>SOFeX</th>
<th>$C_p^A$</th>
<th>SOFeX</th>
<th>$C_p^B$</th>
<th>$F_A$</th>
<th>$F_B$</th>
<th>Amazon</th>
<th>Isoprene</th>
<th>SOA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.0</td>
<td>2.4</td>
<td>30</td>
<td>7.6</td>
<td>8.4</td>
<td>1.8</td>
<td>0.6</td>
<td>18200</td>
<td>500</td>
<td>20</td>
</tr>
<tr>
<td>Max</td>
<td>12.7</td>
<td>2.6</td>
<td>130</td>
<td>&gt;10</td>
<td>34</td>
<td>8.4</td>
<td>2.2</td>
<td>20000</td>
<td>2000</td>
<td>60</td>
</tr>
<tr>
<td>Min</td>
<td>0.1</td>
<td>0.1</td>
<td>3.0</td>
<td>&lt;2</td>
<td>1.4</td>
<td>0.2</td>
<td>0.1</td>
<td>7000</td>
<td>80</td>
<td>2</td>
</tr>
</tbody>
</table>

Reports: “The phosphothreonine lyase activity of a bacterial type III effector family” by H. Li et al. (16 Feb., p. 1000). A production error caused some of the data labels in Fig. 3C to be obscured. A corrected version appears below on the left.

**Address:** “Phytoplankton and cloudiness in the Southern Ocean” by N. Meskhidze et al. (1 Dec. 2006, p. 1419). In Table 2, the $C_p^A$, $C_p^B$, $F_A$, $F_B$, isoprene, and SOA values were incorrect. The corrected table is shown above. For detailed table legend, see original paper.

**TECHNICAL COMMENT ABSTRACTS**

**Comment on “Wandering Minds: The Default Network and Stimulus-Independent Thought”**

Sam J. Gilbert, Iriose Dumونtheil, Jon S. Simons, Chris D. Frith, Paul W. Burgess

Mason et al. (Reports, 19 January 2007, p. 393) attributed activity in certain regions of the “resting” brain to the occurrence of mind-wandering. However, previous research has demonstrated the difficulty of distinguishing this type of stimulus-independent thought from stimulus-oriented thought (e.g., watchfulness). Consideration of both possibilities is required to resolve this ambiguity.

Full text at www.sciencemag.org/cgi/content/full/317/5834/43b

**Response to Comment on “Wandering Minds: The Default Network and Stimulus-Independent Thought”**


Gilbert et al. suggest that activity in the default network may be due to the emergence of stimulus-oriented rather than stimulus-independent thought. Although both kinds of thought likely emerge during familiar tasks, we argue—and report data suggesting—that stimulus-independent thought dominates unconstrained cognitive periods.

Full text at www.sciencemag.org/cgi/content/full/317/5834/43c