LETTERS

Edited by **Jennifer Sills**

Include macrofungi in biodiversity targets

Macrofungi species such as caterpillar fungus (*Ophiocordyceps sinensis*) are used in herbal remedies.

From 3 May to 9 June, the Subsidiary Body on Scientific, Technical, and Technological Advice met to negotiate the development of the post-2020 global biodiversity framework for formal release at the 15th meeting of the Conference of the Parties (COP15) to the Convention on Biological Diversity (CBD). Like the previous CBD agreement (*1*), the current proposed draft does not explicitly mention macrofungi (*2*). This major lineage of life should not be overlooked again.

Macrofungi include species in the fungal kingdom with sporocarps (fruiting bodies) visible to the naked eye. They are a primary source of food and pharmaceutical products that contribute to the sustainable livelihood, health, and well-being of humankind (*3*). The global mushroom trade reached USD54.58 billion in 2020 (*4*). However, macrofungi are threatened by habitat decline and degradation, land use change, and climate change (*5*). About 5% of the macrofungi in Europe and Central Asia are at risk of extinction (*5*). Important macrofungi, such as *Ophiocordyceps sinensis*, a caterpillar fungus thought to have valuable medicinal qualities, and *Tricholoma matsutake*, a popular edible mushroom, have considerably declined (*6*, *7*).

Recent advances have paved the way for macrofungal assessment and monitoring. For instance, the International Union for Conservation of Nature (IUCN) initiated the Red List Initiative for Fungi in 2014 and has nominated 1764 species for assessment (*8*). So far, 425 species, mostly macrofungi, have been assessed and given a global conservation status (*9*). A more comprehensive list should be enacted for worldwide macrofungal conservation, supported by approaches such as rapid triage by artificial intelligence (*10*). Molecular technologies, such as DNA (meta)barcoding (*11*), could be used in conjunction with morphological identification of macrofungal species to ensure rapid, large-scale, and efficient monitoring.

The CBD has proposed a series of monitoring elements for flora and fauna, such as trends in population and extinction risks, wild species used for food and medicine, and biological resources harvested for legal use (*12*). By extending such monitoring to macrofungi, the CBD could emphasize the importance of assessing and protecting these species. The post-2020 global biodiversity targets will be agreed upon at the COP15 in October, locking in international conservation priorities for the next decade. Mycologists and decision-makers should seize this critical opportunity to ensure that macrofungi are included.

Yun Cao[1]*, Gang Wu[2], Dandan Yu[1]*
[1]Key Laboratory of Biosafety, Nanjing Institute of Environmental Sciences, Ministry of Ecology and Environment of China, Nanjing 210042, China. [2]Key Laboratory for Plant Diversity and Biogeography of East Asia, Kunming Institute of Botany, Chinese Academy of Sciences, Kunming 650201, China.
*Corresponding author. E-mail: caoyun@nies.org (Y.C.); dan.d.yu@hotmail.com (D.Y.)

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Ocean acidification science stands strong

In his News Feature "Sea of doubts" (7 May, p. 560), M. Enserink reports on fraud allegations in about one-fourth of the studies analyzing the impact of ocean acidification on fish behavior. As institutions work to determine whether there is truth to the allegations, which have not yet been independently verified, the public and policy-makers should remember that the outcome will not change the current scientific consensus: Ocean acidification is a major threat to marine species, ecosystems, and associated services.

No single article, research team, or approach can explain the complexity of the consequences of ocean acidification (*1*). Over the past two decades, thousands of scientific articles have been published in this field, combining a wide range of approaches and methods from monitoring, paleo investigations, and modeling to laboratory, natural, and field experiments (*2*). The Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) (*3*, *4*) concluded with high confidence that both positive and negative impacts on marine organisms and ocean processes occur and that responses can be influenced, and often exacerbated, by other drivers such as warming and hypoxia. The effect on fish behavior is mentioned in the

report, but it only marginally contributed to the IPCC conclusions and was assigned a medium to low confidence level in light of uncertainty about the long-term persistence of behavioral disturbances.

The science of ocean acidification stands strong whatever the outcome of the investigations of potential misconduct in the area of effects on fish behavior. Failure to quickly mitigate ocean acidification through ambitious reduction of CO_2 emissions would have substantial consequences for the ocean and human societies.

Sam Dupont[1]*, Jean-Pierre Gattuso[2], Hans-Otto Pörtner[3], Steve Widdicombe[4]
[1]University of Gothenburg, Fiskebäckskil, Sweden. [2]Centre National de la Recherche Scientifique, Sorbonne Université, Iddri, France. [3]Alfred Wegener Institute, Bremerhaven, Germany. [4]Plymouth Marine Laboratory, Plymouth, UK.
*Corresponding author. Email: sam.dupont@gu.se

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The risks of solar geoengineering research

As the climate crisis worsens, pressure is mounting for world leaders to accelerate climate action. A National Academies of Science, Engineering and Medicine report (*1*) released in March recommends that the United States invest unilaterally to expand research on solar geoengineering, a set of controversial proposed strategies to cool the planet by reflecting sunlight back to space. However, unilateral, preemptive research without broad public participation, and before a global governance structure is established, risks exacerbating international conflict and undermining progress on energy system transformation away from fossil fuels in the highly contested and politicized landscape of global climate policy (*2*–*4*).

The idea of a technical intervention to counter global warming may have some appeal, but the social, political, and environmental risks associated with solar geoengineering research need to be prioritized in policy discussions (*2*, *5*, *6*). Given the dangers of advancing solar geoengineering (*7*), including further concentrating power among elites (*2*) and deterring mitigation efforts (*4*), inclusive processes for public deliberations on whether, when, and how public funding should be provided to support climate manipulation are essential. Advocacy for solar geoengineering research continues to be dominated by white male scientists from the Global North funded by tech-billionaires and elite philanthropy (*8*). More diverse voices are needed to expand public discourse beyond the narrow technocratic narrative that limits authentic deliberation about the risks.

The United States is already the world leader in solar geoengineering research, but given widespread distrust of the country's leadership on climate change (*9*), and the legacies of unilateral US action in international affairs, fear of US unilateralism in advancing solar geoengineering technology is likely to increase risks of militarization or securitization of this planetary-scale intervention (*10*). Research on solar geoengineering, therefore, if it is to proceed, needs to be multilaterally governed under the United Nations systems (*11*, *12*). Rather than establishing a unilateral US research program on global manipulation of Earth's climate, the Biden/Harris administration should expand US investment in multilateral, coordinated efforts to reduce fossil fuel reliance, advance global climate action, and commit to climate justice.

Jennie C. Stephens[1]*, Prakash Kashwan[2], Duncan McLaren[3], Kevin Surprise[4]
[1]School of Public Policy & Urban Affairs, Northeastern University, Boston, MA 02115, USA. [2]Department of Political Science, University of Connecticut, Storrs, CT 06269, USA. [3]Lancaster Environment Centre, Lancaster University, Lancaster LA1 4YQ, UK. [4]Environmental Studies, Mount Holyoke College, South Hadley, MA 01075, USA.
*Corresponding author.
Email: j.stephens@northeastern.edu

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Yun Cao, Gang Wu and Dandan Yu

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