LETTERS

Wildfires burned parts of Australia's ancient rainforests, including the lowland rainforest in Terania Creek, Nightcap National Park.

PHOTO: ROBERT M. KOOYMAN

Edited by **Jennifer Sills**

Protect Australia's Gondwana Rainforests

Recent fires in the Gondwana Rainforests of eastern Australia, a UN Educational, Scientific and Cultural Organization (UNESCO) World Heritage site (*1*), exposed the country's inability to protect these unique forests. Rich in diversity and global fossil heritage, the Gondwana Rainforests harbor the highest concentrations of threatened species in subtropical southeast Queensland and northern New South Wales, and they protect more than 40 million years of globally significant rainforest evolutionary history (*2*–*9*). Australia must take steps to ensure that these forests will not be lost in future natural disasters.

Australia began to break from Gondwana (Antarctica) around 40 million years ago (*3*), carrying its remnant of Austral paleorainforest and deep time evolutionary history. On its journey north, the Australian continent escaped the ravages of Antarctic freezing, only to heat up and dry out much later as it approached the tropics (*4*, *5*). The Paleo-Antarctic rainforest lineages (PARLs) retreated to the few remaining, geographically restricted and still shrinking wet places (*2*, *4*). PARLs are living plant taxa with fossil records in the mid-high latitude paleorainforests of the Cretaceous and Paleogene Southern Hemisphere (*2*, *3*), and their existence in Australia's living World Heritage Gondwana Rainforests preserves a vestige of the mostly vanished, late-Gondwana rainforest ecosystems that once covered much of the southern half of the planet (*4*, *6*–*9*). The greatest concentration of threatened rainforest plant species in Australia, many of them PARLs, now resides in the Nightcap Range in northern New South Wales (*10*). Efforts to protect this incredible concentration of diversity have proven inadequate (*11*).

Although the fires are now under control, more than 50% of the Gondwana Rainforests were affected by them (*11*). Australia must learn from this experience. Before the next threat arrives, Australian state governments should identify natural assets that are at risk and put policies in place to improve fire planning, streamline fire responses, and protect these forests. Legislation should prioritize areas of high conservation value, implement strategic fire planning to protect the forests, and avoid implementing broad-area industrial-scale controlled burns. Meanwhile, scientists must work to generate baseline scientific data for these areas immediately, which can be used to assess the damage from the recent fires and better predict fire behavior in the future. If policy-makers fail to heed the lessons of the recent fires, the world could lose Australia's ancient Gondwana Rainforests.

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Post-2020 goals overlook genetic diversity

In January, the secretariat of the Convention on Biological Diversity (CBD) released the first draft of a post-2020 global biodiversity framework with goals and targets for biodiversity (*1*, *2*). We are deeply concerned that the goal suggested for genetic diversity—the basic element for evolutionary processes and all biological diversity—is weak. Abundant scientific evidence recognizes the crucial role of intraspecific genetic diversity in ecosystem resilience, species survival, and adaptation, especially under increased threats of climate change, habitat loss, and diseases (*3*). The new goals should correct omissions in the previous strategy document.

The previous biodiversity strategy, CBD 2011–2020, includes Aichi Target 13 on

A Royal Society Summer Science Exhibition attendee learns about the helium atom microscope.

OUTSIDE THE TOWER

Outreach that sticks

I stood in our booth at the Royal Society's 215th Summer Science Exhibition, eagerly awaiting a chance to share with the attendees the hands-on activities describing the physics of our cutting-edge research—the result of a collaboration between two groups half a world apart. A group of three teenagers hesitantly approached the exhibit, nervous as to whether to engage. "Would you like to try our challenge?" I asked. "Match the pictures of the object to the image from our microscope." Immediately, their apprehension vanished, and they set about the task.

I watched as they matched macroscopic images of a honeybee and a spider to a close-up of the hairs on the bee's eye and the fang in the spider's tiny mouth. When the students finished analyzing the images, I explained that the close-up photographs were created using a novel helium atom microscope, which shows extraordinary details at micrometer scale without damaging the sample. By then, they had overcome their preconceptions about the difficulty of physics, and their questions flowed: "How were these images made?" "Why is this microscope different?" "What can it be used for?" Their natural scientific curiosity and confidence had been revitalized.

Call for submissions
Outside the Tower is an occasional feature highlighting scientists' advocacy experiences. Submit your advocacy story at http://cts.sciencemag.org.

Our exhibit accomplished our mission for the day—to engage an audience ranging from young children to distinguished Fellows of the Society. However, it was only the first step to lifelong learning in science, technology, engineering, and mathematics (STEM). Although one-off interventions can inspire, the lack of participation in STEM will not be solved just by increasing interest (*1*).

To boost the long-term effects of our outreach efforts, we sent students and teachers on their way with curriculum-linked resources provided through an online program (*2*). With hints, videos, and teacher support available online, they could solve problems related to the exhibition and make connections between science lessons in school and a career in research. We hope that our model of inspiration followed by long-term engagement will allow students to experience the euphoria of success and the resilience needed to become the researchers of the future.

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COMPETING INTERESTS

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genetic diversity, which focuses on "cultivated plants and farmed and domesticated animals" and their wild relatives. Indicators associated with Target 13 follow trends, number, and threat status of domestic animal breeds and crops (*4*). Although the post-2020 CBD draft includes a much-needed goal to maintain genetic diversity, it does not explicitly state that genetic diversity maintenance is crucial for all species, not just a few. Because no indicators to follow trends of genetic diversity of wild animals and plants are suggested in the draft, genetic diversity could continue to be considered only for domestic organisms, as it was under Target 13.

The newly proposed framework should incorporate several revisions before it is finalized. The post-2020 framework should explicitly commit to maintaining genetic diversity within all species and to implementing strategies to halt genetic erosion and preserve adaptive potential of populations of both wild and domesticated species. The framework should also define indicators of progress toward this goal (*5*). Such indicators could include collecting data on the number of species, populations, or metapopulations that are large enough to maintain genetic diversity as well as those that are not. A widely used measure in this context is the "genetically effective population size," which quantifies the rate at which a population loses genetic variation. When the effective size is measured as 500 "ideal individuals," the population is considered "genetically safe" (*6*, *7*). We therefore suggest monitoring the number of populations above and below the genetically effective size of 500. The effective size is assessed from genetic or demographic data and is usually much lower—by about an order of magnitude (*8*)—than the total number of mature individuals. Another indicator could be the number of species or populations in which genetic diversity is being monitored by national agencies or universities using DNA-markers. A third indicator could be measuring rates of loss of distinct populations within species.

It is encouraging that the CBD post-2020 draft includes genetic diversity in one of the five main goals. However, including explicit protection for genetic diversity in wild as well as domestic species, and strategies to measure the effectiveness of efforts toward that goal, will ensure that signatories prioritize this important aspect of biodiversity conservation.

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COMPETING INTERESTS

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