

Edited by Jennifer Sills

Island outlook: Warm and swampy

IN HIS IN DEPTH News story “Warming may not swamp islands” (1 August, p. 496), C. Pala argues that “coral reefs supporting sandy atoll islands will grow and rise in tandem with the sea,” based largely on studies that showed stable Pacific-island area over recent decades (1–4). He suggests that recent land losses are driven mostly by bad choices and that islanders are being affected “for the same reason as millions of people on the continents: because they live too close to shore.” We disagree with these conclusions.

Pala bases his arguments on (i) evidence that reefs can build vertically at 10 to 15 mm/year, a rate far exceeding the anticipated rate of sea-level rise, and (ii) sequential air photographs that document stable island areas despite rising sea level. An analysis of the early literature (i.e., pre-1999) revealed 22 articles reporting much lower reef-accretion rates—0.60 to 7.89 mm/year, averaging 3.54 (see supplementary materials). More recent reviews similarly conclude that rates of 10 to 15 mm/year are much too high for Holocene reef building (5–8). Recent declines in coral cover can only slow accretion in the future.

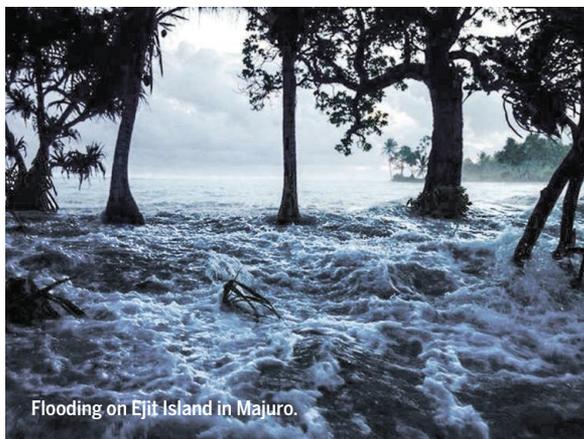
Naomi Biribo has noted that “widespread erosion along the ocean and lagoon shorelines is primarily due to human activities” (3). However, the same paper also attributes 90% of the increase in island area on South Tarawa to reclamation projects (i.e., no inherent ability to keep pace with sea level naturally). Island area may not provide an adequate measure of either changing sediment volume or the susceptibility of the island to flooding, erosion, or drowning. It is possible that erosion of sand from higher marginal areas and redistribution to lower shorelines elsewhere on the island can increase island area, even in the face of declining sediment volume.

Pala’s sources describe islands building seaward 4800 to 4500 years ago (3, 9),

a pattern opposite to the island retreat that is occurring today. If rising sea level is to be discounted, then a mechanism to explain this recent reversal must be identified. Also, fewer corals making calcium carbonate and stronger storms removing at least some of it will likely reduce sediment availability.

We also take exception to laying the sole blame at the feet of islanders who have occupied these fragile islands for millennia. Human communities living on atoll islets often depend on thin aquifers, agroforestry, and freshwater wetland taro production. Saltwater intrusion and flooding destroys otherwise sustainable food and water sources (10), making islands unlivable long before drowning.

Certainly the situation has been exacerbated by poor choices, and politics is rarely the best lens for viewing natural phenomena. Adapting to either sea-level rise or more frequent inundation often



Flooding on Ejit Island in Majuro.

involves ill-placed engineering solutions that require substantial volumes of sand and rock that would be better left in place to protect coastlines and contribute to island sediment budgets. The meteorological instability that comes with rising temperatures, the likely increase in erosion and storm surge, islands constantly retreating from the sea, dwindling groundwater supplies, decreasing rainfall, and rising sea level will all have disproportionate impacts on populations that are least responsible for the global carbon emissions that are at the heart of these changes.

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SUPPLEMENTARY MATERIALS

www.sciencemag.org/content/345/6203/1461/DC1
Table S1
References (11–32)

Lab animal protection overdue

WHEN THE INSTITUTE of Medicine (IOM) concluded in 2011 that most current use of chimpanzees in biomedical research was “unnecessary,” it highlighted systemic deficiencies in the oversight of experiments on animals (1). Specifically, harmful and invasive experiments on chimpanzees continued to be reviewed, funded, approved, and conducted at government and private facilities—all of which were accredited by the Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC)—despite the studies’ irrelevance to human health and/or the availability of alternative research methods. It was only when

the public, activists, and Congress raised questions that the problem was discovered and rectified, leading to the retirement of most federally owned chimpanzees, the discontinuation of most federally funded biomedical experiments on chimpanzees, and a complete overhaul of the process by which federally funded experiments on chimpanzees are reviewed. Oversight and accreditation from AAALAC certainly did not protect these chimpanzees from painful and unnecessary experiments at laboratories across the country.

In his In Depth News story “Animal welfare accreditation called into question” (29 August, p. 988), D. Grimm describes a study led by Justin Goodman, the director of the Laboratory Investigations Department at People for the Ethical Treatment of Animals (PETA). Goodman *et al.*'s study shows that AAALAC-accredited laboratories are more likely to violate animal welfare laws than nonaccredited laboratories. The results lend credence to the idea that AAALAC may not deserve the designation as the “gold standard” for laboratory animal care.

This new analysis, the IOM report, and other studies like them [e.g., (2, 3)] highlight the need for oversight mechanisms that are truly independent, unbiased,

and transparent, none of which apply to AAALAC in its current incarnation.

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4. The opinions expressed here are solely those of the author and do not necessarily represent the opinions of the U.S. Government or the U.S. Food and Drug Administration.

Prenatal prevention

THE EDITORIAL “A focus on child development” (K. L. Silver and P. A. Singer, 11 July, p. 121) rightly calls attention to the final United Nations report on Sustainable Development Goals and the need to address the developmental origin of health and disease in the successor to the Millennium Development Goals. Silver and Singer highlight the postnatal risks to the world's children and the need to ensure “that children who survive reach their full potential.” However, a child is vulnerable from the time of conception.

Some organ functions and noncommunicable disease risks are determined during prenatal development (1). This is particularly true for brain development, where exposures to substances such as methylmercury and ethanol during pregnancy have led to clear cognitive and behavioral abnormalities that may even be present at low levels of exposure (2).

As Silver and Singer point out, “society only reaps the full benefits...if that child becomes a productive individual as an adult.” In terms of lost income associated with neurobehavioral deficits, current exposures to environmental pollutants are causing societal losses in terms of many billions of dollars annually. The worldwide loss due to lead alone has been estimated to be at least 1% of the GDP (3). Prevention of this “chemical brain drain” would be a highly rewarding investment.

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