LETTERS

Edited by **Jennifer Sills**

Emergency response for marine diseases

MARINE DISEASES CAN decimate populations and can have substantial ecological, economic, and social impacts. Recent disease outbreaks in marine mammals, shellfish, sponges, seagrasses, crustaceans, corals, and fishes demonstrate the potential for catastrophic effects, including reduced biodiversity, community shifts, local extirpation of species, disruption of ecosystem services, and loss of fisheries (*1*, *2*). Currently, seastar wasting syndrome threatens marine populations by impairing ecological integrity through shifts in populations of foundation species and declines in ecosystem services. In the past year, over 20 seastar species on both coasts of the United States have declined to the point of local extirpation (*3*).

At this point, very limited funding is available to identify, monitor, forecast, and mitigate marine diseases. The Marine Disease Emergency Act (H.R. 5546), reintroduced by Rep. Dennis Heck (D-Wash.) to the House of Representatives in February 2015, would provide immediate resources to mount a rapid response when marine infectious diseases are first detected. If the legislation passes, the funding would enable (i) a basic research program to increase diagnostic tools, understand pathogenesis, and quantify epidemiological processes; (ii) a surveillance program to identify marine disease outbreaks; (iii) a marine disease forecasting program; and (iv) directed mitigation programs to reduce the intensity of disease outbreaks and their downstream impacts [e.g., (*4*)]. These activities were only possible to a very limited extent during the recent seastar wasting syndrome outbreaks.

As our global reliance on oceans for food, ecosystem services, and cultural activities rises, anthropogenic stresses to the oceans are increasing, creating new opportunities for disease. This past year (2014) was also the warmest on record, and continually rising temperatures under climate change are predicted to increase seagrass wasting disease, seastar wasting, abalone withering syndrome, coral bleaching, infectious coral diseases, and risk for human infection by zoonotic vibrio species (*5*–*8*). If passed, the Marine Disease Emergency Act will greatly enhance capacity for rapid responses to marine disease outbreaks, maximizing opportunities for research and management of these diseases and their downstream impacts.

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Ochre star losing its second arm to wasting disease.

PHOTO: DREW HARVELL

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Sparing grasslands: Map misinterpreted

J. W. VELDMAN *et al.* argue that the world's ancient (old-growth) grasslands should be spared from restoration-motivated tree planting ("Tyranny of trees in grassy biomes," Letters, 30 January, p. 484). We strongly agree. However, they also claim that the global Atlas of Forest Landscape Restoration Opportunities (*1*–*3*)—created by the World Resources Institute, International Union for Conservation of Nature, and University of Maryland—calls for such afforestation. It does not.

Forest Landscape Restoration (FLR) is a process to regain ecological integrity and enhance human well-being in deforested or degraded forest landscapes (*4*). Its goal is to enhance native ecosystem functions and biodiversity, not to increase forest cover per se. FLR does not call for increasing tree cover beyond what would be ecologically appropriate for a particular location, and should not cause any loss or conversion of natural forests, grasslands, or other ecosystems.

We created the Atlas to estimate the global potential for FLR, thereby underpinning the formulation of the Bonn Challenge ("to restore 150 million hectares of deforested and degraded forest lands by 2020") (*5*), and to identify areas where a more refined analysis is warranted.

It is important to note that the map is coarse. We used only globally consistent geospatial data sets at a 1-km resolution. We defined forest landscapes broadly, considering climate, soils, and ecoregions. All lands biophysically capable of supporting a tree canopy cover of at least 10% were included.

Given its coarseness, the Atlas was not intended or designed as a tool to guide precisely where restoration should occur, or to decide what interventions may be suitable for a particular location. Rather, national and subnational assessments are needed to determine what is ecologically, socially, and economically appropriate in a particular context. These assessments should consider local ecological conditions, engage local experts and stakeholders, use local definitions, and incorporate richer, higher-resolution data. To help with this, we developed a Restoration Opportunities Assessment Methodology (*6*).

To our knowledge, no global map of old-growth grasslands has yet been published. Mapping these areas is difficult, as they form gradients in the landscape, have shifted over time, and depend heavily on the periodicity of fires (*7*), which may or may not have been subject to human influence. We invite researchers, including Veldman *et al.*, to collaborate on a more in-depth mapping of ecosystem restoration opportunities, which can incorporate new information on the world's old-growth grasslands and other important biomes as it becomes available.

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Sparing grasslands: FAO's active role

WE AGREE WITH much of the Letter "Tyranny of trees in grassy biomes" (30 January, p. 484), in which J. W. Veldman *et al.* caution against indiscriminate afforestation in general and especially in grassland areas, as well as acknowledge grasslands' substantial contribution to carbon sequestration (*1*, *2*). We consider it misleading, however, to claim that because grasslands are not "formally" recognized, they are not actively studied and considered in ongoing activities of the U.N. Food and Agriculture Organization (FAO).

The FAO has been working on grasslands activities for more than 30 years (*3*) and recognizes that even within grasslands, there are many categories. The FAO's 2005 publication *Grasslands of the World* explicitly includes grassland biomes (*4*). We estimate that 26% of the world land area and 70% of the world agricultural area are covered by grasslands, which contribute to the livelihoods of over 800 million people (*5*). We have also developed a grassland database with descriptions of more than 300 grassland species from different grassland ecosystems. The FAO has many grassland-related projects and case studies (*6*), including rehabilitation of degraded areas through protected areas and promoting native grassland species. Two relevant projects are the completed "Range rehabilitation and establishment of a wildlife reserve in the Syrian steppe" and the ongoing, globally focused, "Participatory assessment of land degradation and sustainable land management in grassland and pastoral systems" (*7*). We do acknowledge that the definitions of grasslands need to be harmonized and that more research is needed into understanding these areas.

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