"We thought we were smarter than Mother Nature, and Mother Nature has taught us a lesson. It's a lesson in humility when you realize that, 'gee, I thought I understood something and I don't,'" Okal told *Eos*.

He added that there has to be a precautionary approach regarding megaquakes and that scientists should consider that all long subduction zones of more than 400 or 500 kilometers may produce very large earthquakes in the future. "There are a few places where we felt a little bit too secure, and we have to have renewed and new vigilance," Okal said, specifically noting Tonga and the Kermadec Islands, the Mariana Islands, Java and East Luzon, the Caribbean, and the Solomon Islands.

During the afternoon panel discussion at the EGU General Assembly, scientists also focused on the nuclear crisis affecting Japan that resulted from tsunami waves damaging the Fukushima power plant. "What is in order is a review of nuclear plants," many of which are located along shorelines, Okal said. He recommended that scientists investigate how other such nuclear plants might fare under similar conditions.

Andreas Stohl, senior scientist with the Norwegian Institute for Air Research, Kjeller, Norway, who has developed an atmospheric dispersion model useful for tracking various materials including radiation released at the Fukushima power plant as well as volcanic ash that drifted across Europe last year from Iceland's Eyjafjallajökull volcano, said the risk of nuclear power should not be judged by the accident at the Fukushima power plant, because the event could have been even worse. "We were extremely lucky that the wind was blowing in the right way," out to sea, he said. "Imagine the same situation in a nuclear power plant somewhere in central Europe where, regardless of which direction the wind would blow, it's just a question of which city you pollute most. The risks there will be much higher."

Stohl said that Europe may need an emergency response center to deal with these types of situations, and he also stressed the need for improved prediction models. "That concerns probably ocean models, but that also concerns especially atmospheric models because that is the immediate threat to people," Stohl said. "But there is little opportunity to test these models because, fortunately, these accidents are not happening too often."

—RANDY SHOWSTACK, Staff Writer

FORUM

Making Sense of the Water Resources That Will Be Available for Future Use

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Societally and environmentally important resources can be separated into five major categories: water, food, energy, human health, and ecosystem function. These resources, however, are intimately interlinked (Figure 1). Water, for example, is required for each of the other four resources. Estimating availability of water resources, as well as other resources, requires an assessment of the threats they face. As stated by *Pielke et al.* [2009],

> If communities are to become more resilient to the entire spectrum of possible environmental and social variability and change [*Vörösmarty et al.,* 2000], scientists must properly assess the vulnerabilities and risks associated with the choices made by modern society and anticipate the demands for resources several decades into the future.

With respect to water, the world we live in has finite water resources that are under stress from rising demand due to population growth, urbanization, and industrialization [*Gleick and Palaniappan,* 2010]. According to a United Nations report, the current rate of growth is expected to take world population to 9 billion by the end of this century. More than 80% of this population will be residing in urban areas [*United Nations Department of Economic and Social Affairs,* 2008]. A dramatic expansion in urban and industrialized areas of the world is likely. Thus, knowledge of water that can actually be harnessed for use is the key element in defining society's ability to achieve sustainable living in the 21st century.

Gaining an accurate understanding of how much water will be available for future use requires a multidimensional approach. The water that is usable can occur in various forms such as rainfall, surface water, rechargeable and fossil groundwater, snow, natural lakes, and artificial reservoirs, and through state and international treaties. There are multiple threats to these water resources through health epidemics and contamination, changes in precipitation extremes, population demand, industrial and agricultural consumption, contamination, national water policies, and climate. Lately, the consideration of such issues (or threats) has led to the coining of the term "nexus." A nexus can be regarded as a joint investigation addressing a few key issues, such as the "water-energy nexus," "water-health nexus," "water-weather nexus," or even the

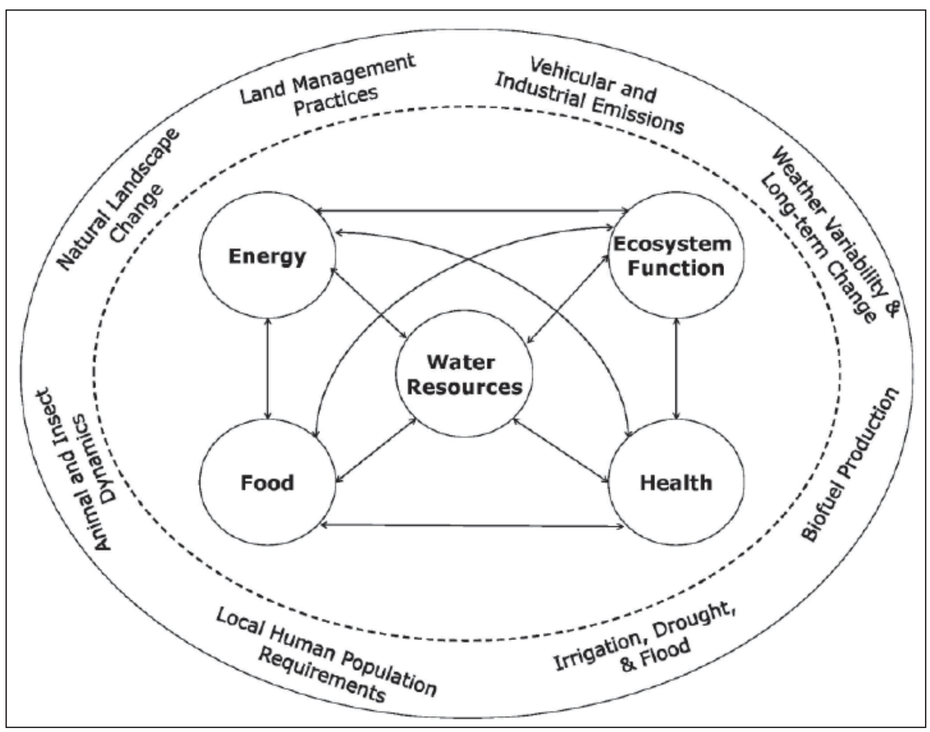

Fig. 1. The relationships among five key resources (water, food, energy, health, and ecosystem function). Outer ring shows a nonexhaustive list of stressors that affect availability or quality of the resources.