G-SCIENCE ACADEMIES STATEMENTS 2012

Building Resilience to Disasters of Natural and Technological Origin

OVERVIEW AND BACKGROUND

Disasters impose huge social and economic costs on societies. By reducing exposure and adopting new strategies to increase resilience, these costs can be reduced. While experience from recent disasters provides useful lessons, a more effective guide to building resilience can be based on systematic scientific risk surveillance and ranking. Since a strategy built on this basis is common to a range of disasters, regardless of their cause, implementing these strategies can be an important investment. It is urgent that national governments build resilience strategies into national, as well as international cooperation and development assistance plans.

DISASTERS

Natural disasters include events such as earthquakes, landslides, hurricanes, floods, typhoons, volcanic eruptions, and disease pandemics. Technological disasters include accidental or human-induced breakdowns in socially critical infrastructures such as dams and levees, energy systems, and information networks. Disasters are often compounded by cascading effects (e.g., East Japan's earthquake-tsunami-nuclear reactor failure). In this statement, we will use the term "disasters" for all of these cases. While some disasters (such as droughts, epidemics, or sinking terrain) may develop gradually, here we focus on disasters that occur on short time scales.

The timing of most disasters cannot be precisely predicted. However, careful scientific study, modeling, and monitoring can improve our understanding of the hazards and exposure, and can often provide valuable early warning. Even for events such as earthquakes, and associated tsunamis, warning of a few minutes can save lives. It is important to reexamine periodically risk exposure. For example, extreme weather events (storms, heat waves, wild fire) may become more frequent and intense as a result of climate and other change, and new geophysical and other data may reveal hazards that were previously unrecognized.

COST OF DISASTERS

Losses and costs of disasters have been increasing. For the first time, global annual losses from natural disasters exceeded $200 billion in 2005, 2008, and 2011. Data on loss of life, on the other hand, has no clear trend—but has been much lower in developed countries, which indicates the value of resilience measures.

The rising cost of disasters is due in part to the continued growth of population and infrastructure in vulnerable locations, aging or compromised infrastructure, and the deferral of needed institutional arrangements and investments in warning and protective systems. Sea-level rise and climate change in the future may also increase risks and impacts from disasters. In many cases, natural systems such as coastal mangroves that buffer disasters have been degraded. Society is increasingly dependent on interacting infrastructures that supply energy, food, health care, information, transportation, and finance. Breakdown in one of these can affect many other services.

Coping with disasters can in many cases exceed the capacity of individual countries, and multiple countries may be impacted.

RESILIENCE TO DISASTERS

Resilience can be defined as the ability of a system and its component parts to anticipate, absorb, accommodate or recover from the effects of a major shock in a timely and efficient manner. Capacity for resilience should be developed in institutions at all levels and sectors of society. In many cases, strengthened resilience has multiple benefits: helping to mitigate immediate deaths, injuries, and economic losses from relatively frequent emergencies, while building resilience to future disasters. Elements of building resilience include:

- Systematic assessment and monitoring of disaster risks, continued research to improve understanding of the underlying causes, improved warning systems, and awareness of risks by the public and all levels of governments.
- Establishment of a culture and incentives that lead to the acceptance of responsibility by communities, including private sector and civil organizations, for planning and cooperation in preparation, response, and recovery.
- Long-term planning, investment, and enforcement of mitigating or preventive measures, such as land-use and other zoning and building codes.
- International cooperation in advanced planning and rapid response, as well as research and evaluation on risk factors.

COMPONENTS OF BUILDING RESILIENCE

Important work is underway within the international community, in particular within the Global Platform for Disaster Risk Reduction and the 10-year Hyogo Framework for Action, adopted by 168 countries in 2005. ICSU (the International Council for Science) launched in 2010 a 10-year program of Integrated Research on Disaster Risk. The UN International Strategy for Disaster Reduction is presently consulting on a post-2015 framework. Such efforts produce a wide range of valuable results and recommendations which deserve sustained attention and implementation.

The adoption of a systems approach and the identification of multi-dimensional solutions are key elements to building resilience. We suggest that particular attention be devoted to these five dimensions, and ask governments to engage the national and international scientific community in this effort:

1. **Repeated Risk Surveillance and Capacity Building for Regular Assessment**. It is hard to prepare for disasters that have not been imagined. Individual regions, nations, and the international community must develop strategies to regularly identify and assess the disaster risks they face and reduce their exposure. Continued monitoring is critical in this regard.

2. **Improvement of Public Health Systems.** Even when an initiating event does not involve public health, large social disruptions can quickly lead to multiple hazards including epidemics. Public health systems must be strengthened and sustained, both to avoid disaster, and to respond when disasters occur. Capacity to respond to health impacts of disasters, especially for vulnerable populations, should be an integral part of (and an additional incentive for) building strong public health systems. The same considerations apply to crop and animal health systems, with their huge impacts on food security and economies. Governments should regularly assess the adequacy of regional, national and international public health preparedness.

3. **Applications of Advanced Information Technology (IT).** Information technologies, including geospatial, are important, both to monitor, identify and warn of pending disasters, and to assess the location, nature and extent of damage, deaths and injuries and dispatch, coordinate and allocate relief efforts. Nations should assess the potential advantages of dedicated IT systems for emergency response versus shared systems that serve multiple roles. Either way, systematic practice (emergency response gaming) with all key players, as well as active programs of public involvement and education, are critical to the effective use of these systems.

4. **Planning, Engineering and Implementation of Standards to Minimize Vulnerability.** Losses from disasters can be significantly decreased by improved standards for buildings, roads, electrical systems, water systems, and other infrastructure, and by zoning to reduce vulnerability. In addition to planning the protection of populations and modern infrastructure, cultural and natural heritage sites require protection, as their loss is irreversible. Continued research on innovative design, engineering and materials and dissemination of information about available techniques and materials are essential. To be effective, governments must see that standards are enforced.

5. **Integration of Resilience Capacity into Development Assistance Programs.** Development assistance programs can help countries build their own capacity for resilience, at both local and national levels. For this to be effective, assistance must reach those most in need so that future vulnerability is reduced. Public education and engagement, drawing lessons from past disasters, and communications capacities are especially important for vulnerable populations and areas. Development assistance, even in crisis situations, should involve institutions and individuals of the afflicted country, to build local experience and capacity.

Our academies of science are committed to working together with over 100 science, engineering, and medicine counterpart organizations around the world to continue the process of better understanding the causes of disasters, finding ways to make society more resilient, making that information widely available, and helping to implement the many actions needed.

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