

3 Fundamental concepts of natural hazard and risk management

by Quality Planning.org¹

3.1 Basic terminology and definitions

The following basic terms and definitions apply throughout this report.

Natural hazard The actual or potential interaction between extreme natural events and human activities that may result in damage, disruption, death or injury.

Hazard The probability or likelihood of a potentially damaging event occurring in a unit of time. Often expressed as the probability of occurrence of a given magnitude of event.

Elements at risk The people, buildings and structures, infrastructure, economic activities, public services, or any other defined values exposed to hazards in a given area.

Vulnerability The expected degree of loss to a given element or set of *elements at risk*, resulting from the occurrence of a natural hazard event of a given magnitude.

Risk Expected losses (i.e. the probability or likelihood of specified negative consequence to life, well-being, property, economic activity, environmental, and other specified values) due to a particular hazard (or group of hazards) for a given area and time period.

Note: items in *italics* throughout the report are those for which further definition and / or information can be found in the glossary section.

3.2 Factors influencing natural hazard and risk management in New Zealand

The drive to develop robust natural hazard and risk management systems in New Zealand has been influenced by a wide range of factors, including the following:

Scientific advances have moved many hazards from a state of being an inexplicable Act-of-God to an understandable and therefore potentially controllable phenomenon.

Many hazards can now be predicted (but not necessarily forecast) at

¹ The date at which this was downloaded and transcribed and the webpage have not been recorded. It is silent on the issue of who is responsible for assessing risks (eg property owners, mortgage lenders, insurance companies, credit rating agencies, willing buyers and sellers, etc) but the implicit presumption is 'none of the above'.

different physical locations and time scales and with different degrees of certainty. Responsible authorities (both public and private) therefore have a duty-of-care and, in some cases, a legislative requirement to use that knowledge to reduce risk from natural hazard (Crozier, 2005).

The impact of natural hazards has been increasing in almost every country, particularly in terms of economic and insured losses (OFDA/CRED EM-DAT, 2005).

The impact of *hydrometeorological hazards*, in particular, has been increasing disproportionately with respect to other hazards and may be related to climate change. In New Zealand, the occurrence of some of these hazards has been linked to climatic patterns of *El Nino Southern Oscillation* (ENSO) and the *Interdecadal Pacific Oscillation* (IPO) (NIWA, 2004).

The recent mainstreaming of climate change reduction and mitigation policies into resource management law and policy and the provision of guidelines has increased awareness of changing natural hazard threats (MfE Guideline on Climate Change, <http://www.qualityplanning.org.nz/plan-topics/climate-change.php#guidance>).

Understanding of the causes of risk and severity of event impact from natural hazards has changed significantly since the 1980s. It has moved from an event-driven, behavioural explanation to an explanation based on vulnerabilities arising from social structures. The term "social structures" is used here in the broadest sense to refer to entities such as legislation, scientific capabilities, emergency centres and resources, and information networks. Today it is understood that, in some cases, damage may be explained as much in terms of community resilience and capabilities as by the magnitude and character of the hazard (Smith, 2004).

In New Zealand, local government and resource management law reform in the 1980s has led to legislation identifying the roles and responsibilities of local government with respect to natural hazards.

Parallel with this law reform there has been a philosophical shift from externalisation of risk (i.e. responsibility for risk being assumed by the wider community and central government) to the localisation and internalisation of risk where those exposed to risk are expected to take some responsibility for risk reduction.

Regional policy statements in New Zealand vary in how they address responsibilities for natural hazard risk management. Some outline a very comprehensive range of issues, objectives, policies, and methods for reducing the risk from natural hazard. Others are very limited in their approach.

Influenced by developments in the nuclear, engineering and financial

industries, generic procedures and standards for managing risk in both the public and private sector have been developed for New Zealand since 1995 and continue to be updated (AS/NZS, 2004a).

Recent events in New Zealand including the Manawatu (2004) and Bay of Plenty (2005) floods have challenged the effectiveness of existing systems and heightened public awareness of the impact of natural hazards.

3.3 The conceptual framework of natural hazard and risk management

The essential prerequisite for initiating a programme of natural hazard and risk management is identifying the existing range of natural hazards and calculating or estimating the measures of risk generated by those hazards. This enables those risks to be evaluated, including ranking and prioritisation.

Unless information exists on comparative risk levels, it is not possible to rationally prioritise effort to establish risk reduction strategies, achieve management goals, and monitor their effectiveness (Crozier and Glade, 2005). Therefore, the first priority of local government towards managing and reducing risk from natural hazards should be to establish programmes that calculate or estimate risk from natural hazards in their jurisdiction.

While research often provides estimates of the relative *susceptibility* of areas to hazard, susceptibility mapping is only of limited use. Knowing that an area is likely to experience hazards is a valuable starting point but, ultimately, if that research is to be of value for natural hazard and risk management, it needs to provide measures of hazard magnitude, frequency and expected consequences, i.e. risk.

3.4 Risk management

Risk management is the systematic process of using administrative decisions, organisation, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impacts of natural hazards and related environmental and technological disasters. This comprises all forms of activities, including risk assessment, structural and non-structural measures to avoid (prevention) or to limit (mitigation and readiness) adverse effects of hazards. It involves the systematic application of management policies, procedures and practices to the tasks of establishing the context, and identifying, analysing, evaluating, treating, monitoring and communicating risk.

3.4.1 Risk management methodology

A conceptual risk management methodology is now well established and recognised both internationally and nationally. This methodology has been established within the Australian and New Zealand risk standards (AS/NZS, 2004a). Although this methodology can be found expressed in many forms, the essentials of the methodology are depicted in Figure 1. (Note: while Figure 1 refers to landslide risk management, the methodology is applicable to all natural hazards).

While some of the procedures in this methodology can be achieved concurrently, there is a necessary and logical sequence required to meet risk reduction objectives.

It should be noted that *risk management* is the overarching process incorporating all aspects of the methodology. It incorporates:

- identifying the hazard;
- identifying the risk;
- analysing the hazard;
- analysing the consequences;
- calculating the risk;
- evaluating the risk; and
- treating the risk.