Defining Risk

Elsewhere in this issue Max Beran refers to the debate on the meaning of risk as a "hardy perennial for debate". Here **Ilan Kelman** surveys the literature on definitions of risk and provides some thought-provoking discussion on our approach to risk and risk management.

When each of us dove into FloodRiskNet, some obvious questions should have poured forth immediately, namely "What is a flood?" and "What is risk?". Simple answers flow from neither question indicating that the combined query "What is flood risk?" may sink us. Such discussions are prone to drowning in pedantic pontificating and definitional drudgery, yet important philosophical points may nonetheless break the surface, particularly in considering risk.

Risk definitions inundate the literature, and a selection are shown in Box 1, but rather than floating legalistic descriptions or wading through dictionaries, a cascade of cautions may better navigate HMS Discussion. Helm (1996) notes that his "simple product is not sufficient in itself to fully describe the real risk, but...it provides an adequate basis for comparing risks or making resource decisions". Sayers *et al.* (2002), in addition to their note that their product is not universally applicable, write "Intuitively it may be assumed that risks with the same numerical value have equal 'significance' but this is often not the case…low probability / high consequence events are treated very differently to high probability / low consequence events".

Lewis (1999) warns that "focus on risk of a given magnitude may cloud our perception of a reality which might in fact be lesser or partial" and suggests that vulnerability is the most important aspect in the risk debate. He observes "Consideration of vulnerability…looks at the *processes* at work between the two factors of hazard and risk. It reverses the conventional approach, and focuses upon the location and condition of the element at risk and reasons for that location and condition…Risk is static and hypothetical, (though reassessable from period to period of time) but vulnerability is accretive, morphological and has a reality applicable to any hazard".

Wilde's (1994) theory of "risk homeostasis" also challenges our understanding of risk and risk management. Risk homeostasis suggests that individuals, and by extension communities and societies, maintain a specific level of risk irrespective of external influences. If we build walls along rivers and coasts to alter flood hazard parameters under certain circumstances, then we will build more property in floodable areas, reduce our preparedness, and behave differently so as to increase our vulnerability (see also Etkin (1999) and Kelman (2001)). The overall risk does not change. Unless the "target risk", the risk we are willing to tolerate or accept, can be altered, external measures do little to reduce total risk over the long-term. Lewis' (1999) discussion implies that targeting vulnerability would reduce Wilde's (1994) target risk.

These concepts based on sociology, psychology, development, human geography, and anthropology run counter to the culture in which many physical scientists and engineers are taught and work. Adams (1995) describes the debate which occurred in 1992 within the Royal Society (London) on studying risk, highlighting the divisions between social scientists and physical scientists.

Physical scientists sought to quantify, to measure, to objectify, to calculate, to scientificify, to nail down risk. Risk can, and more importantly should, be made precise, exact, and accurate. Social scientists viewed risk as contextual and as a cultural construction. The act of measuring, thinking about, and seeking to understand and manage risk changes the risk. Risk definition depends on who defines.

These views are surprisingly similar. Any subpopulation of one individual or more may agree—or be forced to agree or be brainwashed to agree—on a risk definition according to their culture. From this axiom, all which proceeds may be logical. Risk becomes objective and exact within the culture which defines it. But that axiom, that fundamental geometry of risk, may be challenged and redefined. Risk is thus contextual and cultural, dependant upon the initial assumptions which can

Box 1: Selected definitions of risk from the literature

Total risk = Impact of hazard x Elements at risk x Vulnerability of elements at risk

(Blong, 1996, citing UNESCO)

"'Risk' is the probability of a loss, and this depends on three elements, hazard, vulnerability and exposure". If any of these three elements in risk increases or decreases, then risk increases or decreases respectively.

(Crichton, 1999)

Risk = Hazard x Vulnerability x Value (of the threatened area) / Preparedness

(De La Cruz-Reyna, 1996)

"Risk (i.e. 'total risk') means the expected number of lives lost, persons injured, damage to property and disruption of economic activity due to a particular natural phenomenon, and consequently the product of specific risk and elements at risk.

"Total risk can be expressed in pseudo-mathematical form as:

$Risk_{(total)}$ = Hazard x Elements at Risk x Vulnerability"

(Granger *et al.,* 1999)

Risk = Probability x Consequences

(Helm, 1996)

"Risk is a combination of the chance of a particular event, with the impact that the event would cause if it occurred. Risk therefore has two components – the chance (or probability) of an event occurring and the impact (or consequence) associated with that event. The consequence of an event may be either desirable or undesirable…In some, but not all cases, therefore a convenient single measure of the importance of a risk is given by: Risk = Probability × Consequence."

(Sayers *et al.* 2002)

"Risk is the actual exposure of something of human value to a hazard and is often regarded as the combination of probability and loss".

(Smith 1996)

"Risk might be defined simply as the probability of the occurrence of an undesired event [but] be better described as the probability of a hazard contributing to a potential disaster…importantly, it involves consideration of vulnerability to the hazard".

(Stenchion 1997)

Risk is "Expected losses (of lives, persons injured, property damaged, and economic activity disrupted) due to a particular hazard for a given area and reference period. Based on mathematical calculations, risk is the product of hazard and vulnerability".

(UN DHA, 1992)

never be proved or disproved. The observed risk depends on and is affected by the risk observer. The oldest reference in this article is from 1991. What were the axioms defining the risk view 50, 100, and 1000 years ago? What are the contemporary axioms?

Philosophy and ethics have now trickled into the risk debate. If studying risk alters risk, should the studiers take responsibility for the alterations? If communicating flood risk for a community increases the risk of riot, cardiac arrest, stress-related health effects, crashing property prices (including houses in which pensioners have invested their life savings), and the election of a racist councillor, where do our moral obligations lie? How can we rank these different risks? Should we rank these different risks? If refusing to study and communicate risk galvanises positive action (defined how?) more effectively than "objective" analyses in peer-reviewed journals, should we actively oppose risk studies?

Inquiries imply debate. Participation and responses are welcome in order to answer questions, to pose more, or to react to the fact that these questions are asked. Exchange is a vital process for understanding. For understanding risk and flood risk, yes, but also for understanding Flood Risk Net and our roles in and responsibilities towards society. To understand risk, we must understand ourselves.

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