國立臺北大學自然資源與環境管理研究所
九十七學年度第二學期
『環境災害與風險管理』課程講義（二）

主題：危害、危機、災害與相關概念
Hazard, Risk, Disaster and Related Concepts

- DEFINITIONS OF HAZARD, DISASTER AND RISK
  - Hazard 危害、Risk 危機/風險、Disaster 災害 (**S.** p.11-13)
    - ⇨ ***Hazard (cause)*** -- a potential threat to humans and their welfare
    - ⇨ ***Risk (likely consequence)*** -- the probability of a hazard occurring and creating loss
    - ⇨ ***Disaster (actual consequence)*** -- the realisation of hazard
    - ⇨ "Risk is opportunity" (Risk or Crisis) = (Danger + Opportunity)
  - Disasters, Emergencies, Extreme Events, and Hazard (**W.** p.4-13)
    - ⇨ ***Disasters*** are events that occur when significant numbers of people are exposed to hazards to which they are vulnerable, with resulting injury and loss of life, often combined with damage to property and livelihoods.
    - ⇨ ***Emergencies*** are situations that arise out of disasters, in which the affected community's ability to cope has been overwhelmed, and where rapid and effective action is required to prevent further loss of life and livelihood.
    - ⇨ ***Extreme events*** are known natural or manmade events that occur outside their normal range of intensity, energy or size, which often produce life-threatening hazards.
    - ⇨ ***Hazards*** are phenomena or substances that have the potential to cause disruption or damage to humans and their environment. The words threat and hazard are often used in the same way.

- RISK ASSESSMENT AND DISASTER MANAGEMENT– PERSPECTIVES AND ASPECTS
  - Environmental Hazards vs. Natural Disasters
  - Environmental Risk Assessment and Management
  - Changing Perspective (**S.** p.4-8)
    - ⇨ Paradigms: Dominant (Behavioural) vs. Radical (Structuralist)
  - Disaster Management Cycle (**W**. p.3)
    - ⇨ Humanitarian Action vs. Sustainable Development

- ENVIRONMENTAL HAZARDS AND RISK ASSESSMENT
  - Natural Hazards, Technological Hazards, New-Concern Threats (**S.** p.8-10)
  - Voluntary vs. Involuntary; Natural vs. Manmade; Intense vs. Diffuse
  - Risk Assessment: Safety, Health, Ecological, Public Welfare, and Financial
  - Exposure and Vulnerability
    - ⇨ 'End-Points' vs. Scales (Temporal, Spatial, etc.): Chronic vs. Acute
    - ⇨ Risk vs. Security
  - Vulnerability to Disasters
    - ⇨ Vulnerability, Resilience, and Reliability (**S.** p.14-18)
    - ⇨ High Susceptibility and Low Resilience (**W.** p.13-15)

- □ Risk Assessment and Risk Management (**S.** Chp.3)
- □ Steps in Disaster Management (**W.** p.20-22)

- Homework Assignment #1 (March 11, 2009 Due)

  1.請用你自己的文字定義說明“Hazard, Risk and Disaster”及“Vulnerability, Resilience and Reliability”。

  2.請比照上述組合方式提出與風險管理相關之名詞組合二組，並定義說明之。

Table 1.3 Major categories of environmental hazard

1 *Natural hazards* (extreme geophysical and biological events)

- Geologic – earthquakes, volcanic eruptions, landslides, avalanches
- Atmospheric – tropical cyclones, tornadoes, hail, ice and snow
- Hydrologic – river floods, coastal floods, drought
- Biologic – epidemic diseases, wildfires

2 *Technological hazards* (major accidents)

- Transport accidents – air accidents, train crashes, ship wrecks
- Industrial failures – explosions and fires, release of toxic or radioactive materials
- Unsafe public buildings and facilities – structural collapse, fire
- Hazardous materials – storage, transport, mis-use of materials

3 *Context hazards* (global environmental change)

- International air pollution – climate change, sea-level rise
- Environmental degradation – deforestation, desertification, loss of natural resources
- Land pressure – intensive urbanisation, concentration of basic facilities
- Super hazards – catastrophic earth changes, impact from near-Earth objects

Notes: Drought is a slow-onset environmental hazard. Key context hazards are reviewed in Chapter 13.

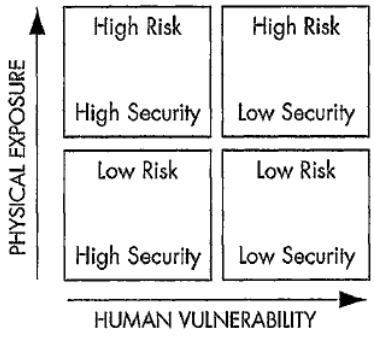

Figure 1.4 A simple matrix showing the theoretical relationships between physical exposure to hazard (risk) and human vulnerability to disaster (insecurity).

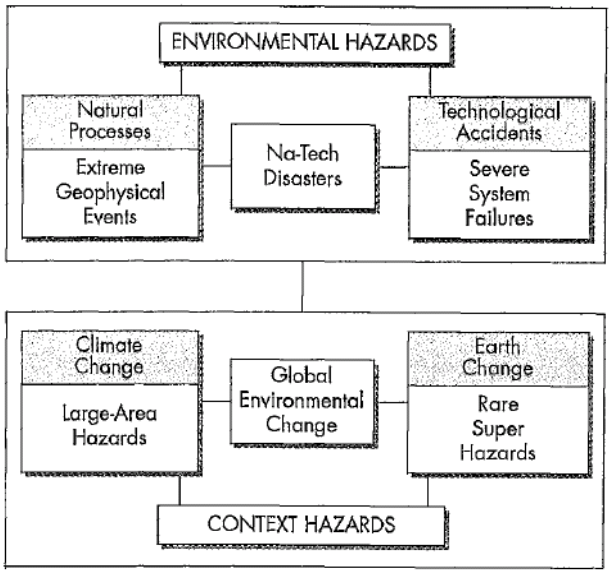

Figure 1.2 The relationship between environmental hazards and context hazards. Context hazards are large-scale threats – both chronic and rare – arising from global environmental change.

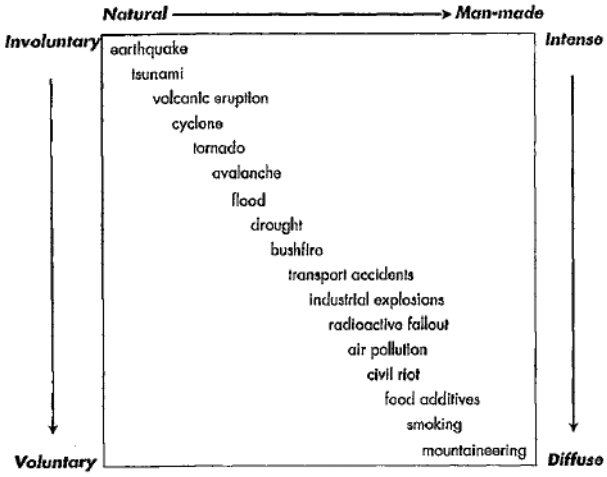

Figure 1.3 A spectrum of environmental hazards from geophysical events to human activities. Hazards with a high level of human causation are more voluntary in terms of their acceptance and more diffuse in terms of their disaster impact.

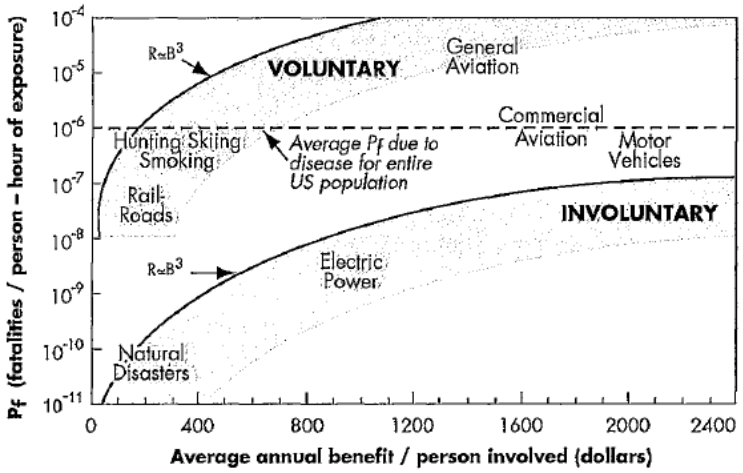

Figure 3.1 Risk (P_f) plotted relative to benefit and grouped for various types of voluntary and involuntary human activities involving exposure to hazard. The diagram also shows the approximate third-power relationship between risks and benefits. The average risk of death from disease is indicated for comparison. *Source*: After Starr (1969). Reprinted with permission from *Science* 165, 1232–8. Copyright 1969 American Association for the Advancement of Science.

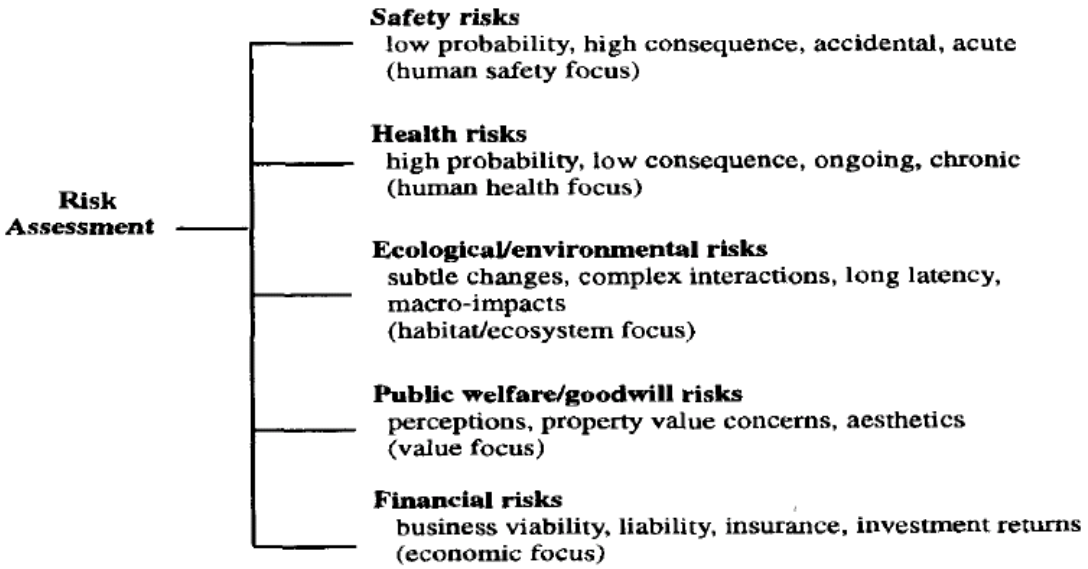

FIGURE 1.1 Major types of risk assessment and their focus.

Figure. 1.1 **The disaster-management cycle**

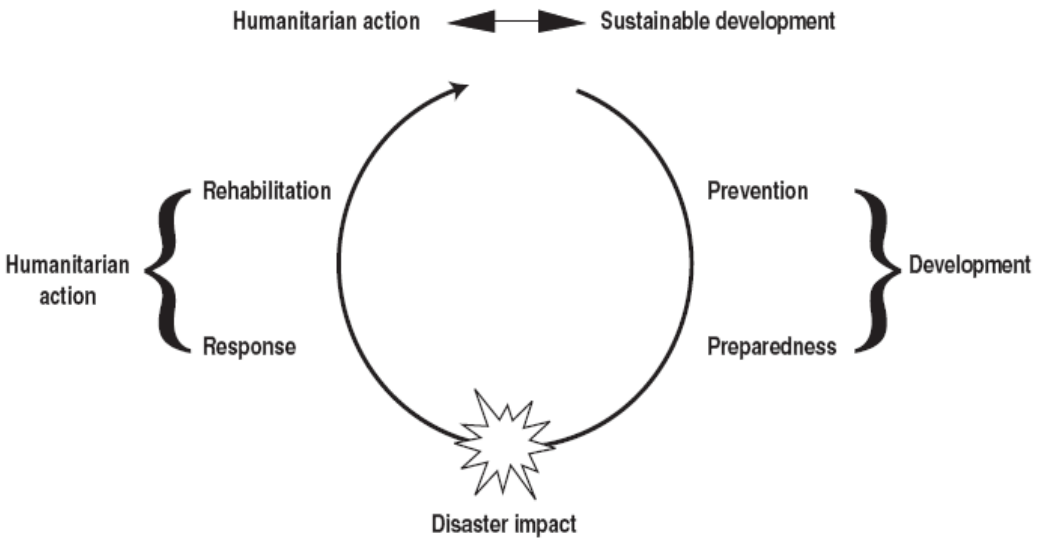

TABLE 1.2 Overview and Comparison of Three Major Types of Risk Assessments

Safety	Human health	Ecological/environmental
	Major steps	
1. Hazard identification	1. Data analysis/hazard identification	1. Problem formulation (hazard screening)
Materials, equipment, procedures, e.g., inventories size and location, flammable, reactive or acutely toxic materials, and initiating events, e.g., equipment malfunction, human error, containment failure.	Quantities and concentrations of chemical, physical, and biological agents in environmental media at a site or study area; selection of chemicals of concern.	Resident and transient flora and fauna, especially endangered or threatened species; aquatic, and terrestrial surveys; contaminants and stresses of concern in study boundary
2. Probability/frequency estimation of causes	2. Exposure assessment	2. Exposure assessment
Likelihood of initiating/propagating events and accidents from internal and external causes.	Pathways and routes, potential receptors including sensitive subgroups, exposure rates, and timing.	Pathways, habitats, or receptor populations, especially valued and protected species; exposure point concentrations.
3. Consequence analysis Nature, magnitude and probability of adverse effects, e.g., fires, explosions, sudden release of toxic materials; meteorology; receptors.	3. Dose-response or toxicity assessment Relationship between exposure or dose and adverse health effects	3. Toxicity effects assessment Aquatic, terrestrial, and microbial tests, e.g., LC_{50}, field studies
4. Risk evaluation Integration of probabilities and consequences for quantitative expression of safety risks; review of acceptable system.	4. Risk characterization Integration of toxicity and exposure data for qualitative or quantitative expression of health risks; uncertainty analysis.	4. Risk characterization Integration of field survey, toxicity and exposure data for characterizing significant ecological risks, causal relationship, uncertainty
	Typical endpoints	
Fatalities, injuries (worker and public safety) Economic loss	Individual and population cancer risks, noncancer hazards	Ecosystem or habitat impacts, e.g., population abundance, species diversity; global impacts.
	Typical applications	
Chemical and petrochemical process safety Hazardous materials transport OSHA Process Safety Management EPA and state risk management programs	Hazardous-waste sites (Superfund, RCRA) Air, water, land permitting Food, drugs, cosmetics Facility expansion or closure	Environmental impact statements Natural Resource Damage Assessments (NRDA) Superfund/RCRA sites Facility siting, wetland studies Pesticide registration

Note: Planning, including clearly defined objectives and reiterative loops, is a key element of all risk assessments.