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（三、四）

主題：天然災害與巨災
Natural Hazards/Disasters and Catastrophes

- ENVIRONMENTAL HAZARDS AND RISK ASSESSMENT
  - □ $\text{Risk} = \frac{\text{Hazard (probability)} \times \text{Loss (expected)}}{\text{Preparedness (loss mitigation)}}$ (**S.** p.36)
  - □ Voluntary vs. Involuntary; Natural vs. Manmade; Intense vs. Diffuse
  - □ Exposure and Vulnerability
    - ⇨ 'End-Points' vs. Scales (Temporal, Spatial, etc.): Chronic vs. Acute
  - □ Human Vulnerability (**S.** p.14-18)
    - ⇨ Vulnerability, Resilience, and reliability
    - ⇨ Vulnerability: the degree of resistance offered by a social system to the impact of a hazardous event.
    - ⇨ Resilience: a measure of the capacity to absorb and recover from the impact of a hazardous event.
    - ⇨ Reliability: the frequency with which protective devices against hazard fail.

- SEISMIC (TECTONIC) HAZARDS (**S**. Chp.5&6)
  - □ Earthquake
    - ⇨ Ground shaking
    - ⇨ Soil liquefaction, Landslides, Tsunamis, *etc.*
  - □ Volcanoes
    - ⇨ Pyroclastic flows and Volcanic gases
    - ⇨ Ground deformation, Lahars, *etc.*

- MASS MOVEMENT HAZARDS (**S**. Chp.7)
  - □ Rock Falls, Landslides and Debris Flows
  - □ Snow Avalanches
  - □ *c.f.* Land Subsidence

- ATMOSPHERIC HAZARDS (**S**. Chp.8)
  - □ Tropical Cyclones
  - □ Severe Summer Storms
  - □ Severe Winter Storms

- BIOPHYSICAL HAZARDS (**S**. Chp.9)
  - □ Thermal Extremes => Frost Hazards

- Disease Epidemics
- Wildfire

- HYDROLOGIC HAZARDS (S. Chp.10&11)
  - Floods
    - ⇨ River floods
    - ⇨ Costal floods
    - ⇨ *c.f.* Forecasting vs. Warning
  - Droughts
    - ⇨ Meteorological, Hydrological, Agricultural, and Famine droughts

- CATASTROPHE MODELING
  - Definition of Catastrophe
    - ⇨ An unexpected or unanticipated natural or man-made event that has wide ranging negative socioeconomic impacts; also known as a disaster.
  - Stakeholders

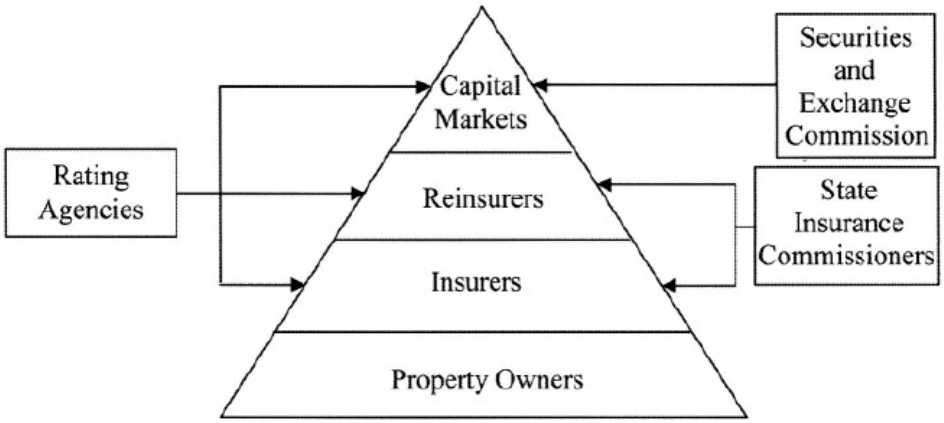

Figure 1.3. Key private sector stakeholders in the management of risk

  - Catastrophe Model
    - ⇨ A computer-based model that estimates losses from natural or man-made hazards, such as earthquakes, floods, hurricanes and acts of terrorism.
    - ⇨ Components

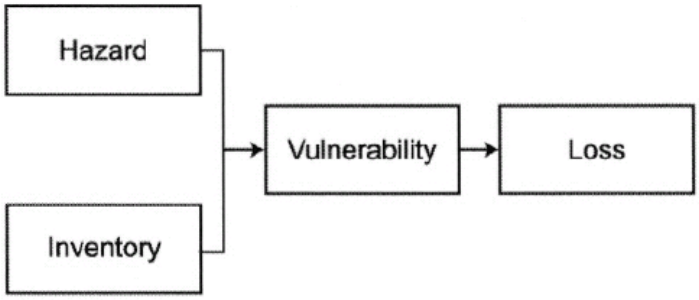

Figure 3.1. Catastrophe model components.

- Homework Assignment #2 (3/25, 2009 Due)

  1.請用你自己的文字定義說明“Catastrophe Bond”。

  2.台灣曾否發行 “Catastrophe Bond”？若有，目前經營情形為何？

Table 2.1 Environmental disasters recorded since AD 1000 responsible for at least 100,000 deaths

Year	*Country*	*Type of disaster*	*Fatalities*
1931	China	Flood	3,700,000
1928	China	Drought	3,000,000
1971	Soviet Union	Epidemic	2,500,000
1920	India	Epidemic	2,000,000
1909	China	Epidemic	1,500,000
1942	India	Drought	1,500,000
1921	Soviet Union	Drought	1,200,000
1887	China	Flood	900,000
1556	China	Earthquake	830,000
1918	Bangladesh	Epidemic	393,000
1737	India	Tropical cyclone	300,000
1850	China	Earthquake	300,000
1881	Vietnam	Tropical cyclone	300,000
1970	Bangladesh	Tropical cyclone	300,000
1984	Ethiopia	Drought	300,000
1976	China	Earthquake	290,000
1920	China	Earthquake	235,000
1876	Bangladesh	Tropical cyclone	215,000
1303	China	Earthquake	200,000
1901	Uganda	Epidemic	200,000
1622	China	Earthquake	150,000
1984	Sudan	Drought	150,000
1923	Japan	Earthquake	143,000
1991	Bangladesh	Tropical cyclone	139,000
1948	Soviet Union	Earthquake	110,000
1290	China	Earthquake	100,000
1362	Germany	Flood	100,000
1421	Netherlands	Flood	100,000
1731	China	Earthquake	100,000
1852	China	Flood	100,000
1882	India	Tropical cyclone	100,000
1922	China	Tropical cyclone	100,000
1923	Niger	Epidemic	100,000
1985	Mozambique	Drought	100,000

Note: These figures are approximations and are biased towards the recent past because of the unavailability of earlier records.
Source: Adapted from Munich Re (1999) and CRED database