Detailed Sources of Information for Hazards Mapping

Most of the information used in natural hazard assessments is generated by three principal networks: international and national natural phenomena research and monitoring centers and universities; disaster management entities; and multisectoral and sectoral planning agencies, ministries, and public utilities. While some may appear in scientific language or as statistical data, other readily usable information may be found in the form of maps, reports, newspaper and magazine articles, proceedings from hazard-related workshops, historical records, etc. Users of hazard information include many agencies at the community, regional, national, and international levels, a number of which are also important produces of information.

1. Natural Resource Maps

a. Climate Maps: Data on a wide variety of climatic factors (including changes, extreme observations, and probabilities) can be obtained in the form of maps, reports, and statistics. Factors include precipitation, temperature, evapotranspiration, wind (velocity and direction), cloudiness, and relative humidity.

b. Geologic Maps: These maps show the distribution, composition, structure, and age of rock units that constitute the foundation of all human activities in the study area. They are useful in determining the location of mineral deposits and construction materials, stability and bearing capacity (and thus the suitability of a location for large engineering structures), soil-forming parent materials, the capacity to store and yield underground water, and the possibility of liquefaction. Large-scale faults and folds are associated with earthquakes, and information on the age and composition of volcanic rocks facilitates volcanic hazard analysis. Small-scale regional tectonic maps show the relative stability of great crusted plates and indicate zones of collision between plates which are the loci of intensive volcanic and earthquake activity.

c. Hydrologic Maps: Surface hydrology maps indicate natural and man-made bodies of water, and may show stream flow (volume, seasonality) and irrigated areas. Groundwater maps show the location and depth of aquifers, water wells, quality of groundwater, etc. These maps can be important in evaluating the potential for floods and drought and also play a role in a vulnerability analysis. They help the planner identify changes in floodplains and recurring flood areas.

d. Landform or Geomorphic Maps: These maps depict the physiographic forms of an area (e.g., mountains, plateaus, mesas, ridges, piedmont, valleys), often relating the form to its geologic origin (e.g., anticlinal ridge, volcanic highlands, alluvial valleys) and thus providing the basis for comprehensive interpretation of soils, land-use potential, and propensity for landslides. The morphological maps are important to planners since they describe the sculpturing of the land by indicating, for example, how the natural forces of erosion have worked towards the establishment of slopes that are relatively stable. They can also reflect the impact of man-made changes. When development unbalances the equilibrium of a stable slope, natural forces immediately set about restoring its equilibrium.

e. Soils Maps: Two different types of soils maps provide planners with valuable information: agricultural soils maps and engineering soils maps. The former can be classified as basic maps and interpretative maps. The basic, or soil unit classification, maps show soil mapping units, usually soil types and phases, and provide information on each unit that usually includes parent material, chemical composition, texture, moisture holding capacity, slope, drainage, and limitations for agricultural use at specified management levels. A wide variety of interpretative maps can be prepared from the soil classification maps, on topics including land classification, suitability for irrigation, trafficability, and erosiveness.

f. Topographic Maps: These maps provide information on elevations, relief, drainage patterns, and culture of an area. They are essential for both vulnerability and risk analyses involving hazards such as high winds, floods, erosion, earthquakes, landslides and volcanic activity. The detail of the information depends upon the scale of the map. Topographic maps are often used as the base maps upon which a variety of thematic maps can be constructed. The features depicted on topographic maps can be grouped under the following heads:

- The hydrography, or water features (ponds, stream, lakes, etc.).

- The hypsography, or relief of surface forms (hills, valleys, plains, etc; elevation above sea level shown by contour lines).

- The cultural features constructed by humans (towns, roads, canals, power lines, etc.).

2. Hazard-related Maps

a. Bathymetric Maps: These maps show the depth and slope of the ocean floor near the shore and are used to assess the potential impacts of storm surges and tides on coastal areas. For example, gently sloping sections of the ocean floor near the shoreline may facilitate storm surge run-up under certain tidal and weather conditions.

b. Desertification Maps

These maps identify areas currently or potentially subject to desertification.

c. Epicenter Maps: These maps show the location of earthquake epicenters. Usually they give the date and depth of an epicenter and the magnitude of the related earthquake.

d. Fault Maps: These maps, which show the location of the major geological fault systems and related geological features, are used to identify the loci of earthquakes and zones of earth movement.

e. Flash Flood Maps*:* These maps contain information on areas historically affected by flash floods. They delimit traditionally affected areas and identify floodplains.

f. Floodplain Maps*:* These maps show rivers, channels, and streams that are susceptible to flooding. They may include information on historical floods, and may also delimit the floodplains and their changes over time.

g. Landslide Maps*:* These maps show the areas where landslides have occurred. They can also include potential areas of landsliding based on geological/hydrological information or on changes related to past development. For these purposes they may illustrate slope stability, gradient and levels of moisture absorption, and the impact of development-induced changes, cohesion, and undermining of soils.

h. Maximum Observed Intensity Maps: These maps demarcate zones where earthquake damage over hundreds of years can be observed or inferred.

i. Seismotectonic Maps*:* These maps delimit seismic zones and trace lines of major dislocations and secondary fractures. They include information on observed tectonic movement.

j. Storm Surge Maps*:* These maps contain information on the heights of past storm surges. They can also provide information on erosion and structural damage caused by storms in coastal areas.

k. Volcano Maps*:* These maps identify the locations of volcanoes and the damage zones where damage from volcanic activity can be observed or inferred.

l. Windstorm Maps: These maps include information on the wind direction and velocity of past hurricanes. They may also provide information on structural damage and damage to the forest or the agricultural sector caused by past storms.

3. Reference Maps for Vulnerability and Risk Assessment

a. Built Structure Maps: These maps illustrate the distribution of buildings in the study area. Usually they are based on data collected from engineering surveys, local directories, land-use maps, inventories of properties, and census data. They may be limited to the buildings themselves, or may extend to other significant features such as age, function, architectural form, and historical or cultural significance. In some instances they provide engineering information such as the distribution and thickness of underlying formations; slopes and slope stability; drainage patterns, permeability, and water table depth; susceptibility to frost; stability in earthquakes; excavation characteristics; suitability for foundations, sub-grade, and fill; and compaction characteristics.

b. Cadastral Maps*:* These maps define the property and ownership boundaries of an area. Although they are often at scales larger than is needed for general regional development planning, they are excellent for hazard management because of their accuracy and detail, especially of lifeline elements and other cultural features.

c. Demographic Maps: Maps with information on single or multiple demographic aspects of an area, usually based on census data, can often be found. As a rule, because of representation problems, they show only certain categories of information. Information on vital statistics is more commonly found in tabular form.

d. Drainage and Irrigation: These maps show coastal and lake zones and river deltas where irrigation, hydrologic energy, and transportation works are often present. They identify natural drainage systems and networks which may be threatened by flooding.

e. Infrastructure Maps: These maps provide essential data on the location, type, and configuration of basic infrastructure (transportation, communication, and energy systems) of the area. Service infrastructure maps show water, sanitation, health, education, and public safety facilities. Coastal infrastructure maps show port and harbor facilities and may include information on historical tides and storm surges. Maps of critical infrastructure show structures which if damaged would endanger lives (e.g., chemical facilities, nuclear plants, dams, and reservoirs).

f. Land-Use and Vegetation Maps: Land-use maps show human use of the land. Depending on the scale, they may indicate various subdivisions of settlement use, cropping patterns, pasture lands, forest plantations, etc. Maps of actual vegetation (as opposed to theoretical maps of potential natural vegetation) show areas of forest, brush, and grasslands, and they may be presented separately or in combination with land-use maps. The depiction of ground cover is useful in determining evapotranspiration, rate of absorption of rainfall, and runoff. They help the planner identify wet and dry season areas.

g. Lifeline and Critical Facilities Maps: Designed to facilitate response to emergencies, these maps show the most important installations necessary for the maintenance of health and public safety. In addition to the basic infrastructure these maps show potable water and sanitation systems, police and fire stations, military posts, emergency management facilities, emergency shelters, and medical services.