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Introduction

The terms prediction and forecast are synonyms, often used interchangeably. The word prediction is of Latin origin, a hybrid of words prae (meaning, before) and dicere (meaning, to say). Prediction, therefore, literally means saying something beforehand. The term forecast is also made of hybrid of words fore (meaning, front) and cast (meaning, to throw). The term forecast therefore means to throw something upfront.

When we talk of prediction and forecasting in the context of natural hazards, for example earthquakes, The difference is that in prediction and forecasting is that in prediction we make a binary statement (one single outcome)—whether earthquake will occur, or it will not occur.

On the other hand, forecast will state a range of possible outcomes for the future in terms of probability of occurrence of an event, like probability of occurrence of an earthquake at a specific location within a certain specified magnitude range and in a particular window of strike time. Such forecasts are usually based on projection of the past into the future through in-depth study and analyses of the available data.

Predictability

- Predictability of a disaster is the key to understand its nature and thereby to assess the chances of its occurrence and the fury of the event.
- For man-made disasters, it is the human error or mechanical fault or organizational failure that is responsible. Therefore, there is no concept of predictability as such for man-made disasters.
- Mock drills, regular inspections and updating of precautionary measures take the place of predictability, forecasting and warning in case of man-made disasters.

Forecasting

- For natural disasters that have a fair amount of inherent predictability, forecasting is the next step in disaster management.
- Forecasting has to be based on sound scientific principles and operationally proven techniques.
- It has to be done by authorized agency or individual. In order to be effective, the
- Forecast has to be clearly worded and it should be transmitted quickly to the user.

Warning

- Once a forecast is available regarding an anticipated disaster event, it has to be converted quickly into an area-specific and time-specific warning.
- The warnings also need to be user-specific because the capacity of different users to withstand 'the impacts of a disaster arc different.

- A warning has no value unless it reaches the users quickly and well in time, Therefore, quick communication is very important at the warning stage,

Predictability of Floods and Droughts

- It is useful to consider these disaster phenomena together in the context of predictability because both floods and droughts are manifestations of the same weather element, viz., water.
- Floods occur due to excess of water whereas lack of water results in droughts. Therefore, the predictability of floods and droughts in fact means the predictability of water, i.e., rain and run off.
- As about 80% of the annual rainfall occurs in the summer monsoon season, the predictability of floods and droughts depends heavily on the predictability of the monsoon rains in the particular area.
- Other aspects which affect the predictability of the flood and rain fall include:
  - Repeated occurrences of heavy rainfall over an area already soaked with rain will certainly give floods.
  - Excess water in a river, due to heavy rains in the upper regions of the river, will create flood downstream.
  - Absence (or lack) of drainage in any area will aggravate flooding there. Similarly, repeated seasons of scanty rainfall will lead to drought conditions
- Predictability of floods and droughts hinges on
  (i) the predictability of rainfall (predictability of the monsoon);
  (ii) whether the earlier rainfall in\the area has been' frequent or infrequent;
  (iii) whether any river flowing through the area is bringing excess water from upstream regions; and
  (iv) whether there is a drainage problem resulting in accumulation of water in the area.

Predictability of Landslides, Avalanches and Forest Fires

- These three phenomena are basically the hazards of mountain areas, Furthermore, rainfall (or snowfall) plays a crucial role although man-made causes increase these hazards to a very large extent.
- Landslides are in fact downslide movement of soil and rock under the influence of gravity. Erosion due to rainfall and floods, or excess loading due to heavy snowfall, or weakening, of ground due to stream erosion, mining quarrying, or earthquake tremors create landslides.
- In case of avalanches, snow loading and strong winds are the basic causes.
- Lack of rainfall and the resulting dryness over large forest areas sustain forest fires triggered by natural causes such as lightning strike or friction, or by man-made

causes such as a burning matchstick or cigarette. Strong winds fan the forest fire and spread it.

- While rain, snow, dryness and winds are predictable, factors such as erosion, excess loading and man-made causes are not predictable, Thus, the overall predictability of disasters such as landslides, avalanches and forest fires is less as compared to floods and droughts.

Predictability of Earthquakes

- Earthquakes are caused by volcanic activity or geological activity. These changes take place deep inside the earth.
- Therefore, earthquakes are not predictable to the extent that the place and time of their occurrence cannot be anticipated.
- The general areas where earthquake activity occurs are known and on a statistical basis, it is possible to indicate that a major earthquake could perhaps occur sometime somewhere within a large region.

Predictability of Cyclones

- Cyclones have the highest predictability among all the disasters.
- As soon as formed over the ocean, cyclones can be detected and tracked continuously with the help of modern instruments such as weather satellites and weather radar.
- The accompanying hazard of storm surge is also predictable through techniques which take into account the parameters of the approaching cyclone as well as the characteristics of the coast including the coastal slope under the sea in the area where the cyclone is expected to hit the coast.

WARNING

- **Warning or Floods**
  - The Central Water Commission (CWC) through its Flood Forecasting Centers issues flood warnings.
  - The State Governments, based on the local experience, fix a "Danger Level" for a river at certain places such as near cities or bridges.
  - CWC issues flood warnings when the river level at a given place reaches or is expected to reach the "Warning Level" which is usually one meter below the "Danger Level". CWC issues flood warnings in the form of "Daily Water Level and Flood Forecast Bulletins".
  - During flood seasons, State Governments set up control rooms at State and District Headquarters which receive the warnings from the Flood Forecasting Centers of CWC and transmit the warning to the affected areas.

- The flood Forecasting Centers also broadcast the warnings through All India Radio as well as Doordarshan and also publish in newspapers for widest possible publicity. The warnings are regularly updated as new observations and forecasts become available.

- **Warning of Droughts**
  - As droughts develop slowly and are caused primarily by continuing deficiency in rainfall or other sources of water, the resulting situation needs to be watched and effective relief action is to be initiated as soon a sowing of seeds or standing crops begin to get affected.
  - There is no warning system as such for droughts. However, the Agriculture and Revenue Departments of the states remain watchful during the dry weather seasons and the situation is monitored regularly especially for those areas, which are known to be drought prone due to local climatic conditions, scarcity of ground water and absence of irrigation facilities.
- **Warning of Landslides and Avalanches**
  - Heavy rains and heavy snowfalls initiate these phenomena and these occur more frequently in areas, which are prone to these disasters due to the peculiar local geological features such as thickness of soil or rock.
  - Therefore, warnings of heavy rainfall/snowfall combined with careful watch by local people serve as an effective alerting system.
  - A local volunteer system is found to be of great benefit and is followed even in the developed countries.
- **Warning of Forest Fires**
  - Periods of extreme dryness combined with absence of rain/snow arc the first indication of the hazard of forest fires. Accumulation of combustible material (such as dry leaves and wood) on the ground adds to the problem.
  - In most cases in our country, forest fires start due to human carelessness. In such circumstances, a system of advance warning is not feasible and usually the smoke or flame is the first warning.
- **Warning of Earthquakes**
  - As earthquakes cannot be forecast as yet, there is no warning system for earthquakes at present.
  - There are areas, which are known to be prone to earthquake activity. Such areas have a standing warning so to say.
  - The country is divided into zones representing the extent of hazard depending on the number and severity of earthquakes that have occurred in the past.

- Regions with a history of strong earthquakes are more hazardous and special care needs to be taken in constructing structures such as multistoried buildings, bridges and dams.
- If areas which have experienced major earthquake activity in the past, remain undisturbed for long periods of many years, this can be taken as a warning (on a statistical basis) that an earthquake could occur somewhere and sometimes in the area. But this can only be taken as a general warning because the exact place and time of the next earthquake in the area cannot be indicated.
- Another 'warning indication is the continued occurrence of tremors at a place although it is not possible to be sure whether the tremors are indicative of ail impending earthquake or they denote nature's method of releasing the earth's internal stress in short bursts of tremors.
- In certain cases, some warning signals occur before an earthquake such as unusual behavior of animals and reptiles, sudden lowering or rising of water level in wells and widening of existing natural cracks in the earth's surface.

- **Warning of Cyclones**
  - Cyclone warnings are issued by the India Meteorological Department (IMD) through its Area Cyclone Warning Centers (Mumbai, Kolkata and Chennai) and Cyclone Warning Centers (Ahmedabad, Bhubaneshwar and Visakhapatnam).
  - In the first stage of warning, a 'Cyclone Watch" is maintained during the cyclone seasons in the pre-monsoon and post-monsoon and post-monsoon months.
  - In the second stage. "Cyclone Alert" is issued 48 hours (two days) before the expected commencement of bad weather along the coast.
  - Warnings to ports and 'fishermen start earlier, the ports display the warnings by hoisting special visual signals to warn boats and ships.
  - Warnings are updated regularly according to the progress of the cyclone, which is kept under constant observation through satellite and radar equipment.
  - "Cyclone Warnings" are commenced 24 hours before the anticipated landfall i.e. the anticipated time the cyclone is expected to hit the coast.
  - These cyclone warnings are updated every hour and more frequently if the situation so demands.
  - Cyclone warnings are sent to the port, airports. railways, State and District authorities. These are issued to press and broadcast through radio and television.
  - For quick and' effective communication of cyclone warnings to the field areas likely to be affected, a special system called Disaster Warning System (DWS) has been implemented in the coastal areas.
  - By this system, cyclone warnings in local language are broadcast from the Area Cyclone Warning Centre of IMD to the field area directly via INSAT and this warning is received through a small apparatus installed at schools and district offices or panchayats in the coastal region.

Reference

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