

Disaster Management “Mitigation of Inevitable Accident”

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Abstract

Learning administration can assume a fundamental part through guaranteeing the accessibility and availability of precise and solid debacle chance data when required and through viable lesson learning. Recognizable proof of key debacle information components will be an empowering influence to oversee catastrophes effectively. Each nation and group is powerless against calamities, both characteristic and artificial. Country's geoclimatic state besides its hoisted condition of financial acknowledgement makes it by walking most extreme fiasco nation on the planet to encounter all the time from different cataclysmic events, in particular dry spell, surge, violent wind, earth tremor, avalanches, volcanic emission, and so forth. The objective behind this paper is to exhibit key learning factors identifying with debacle administration cycle, and investigates a couple of difficulties identifying with recognized catastrophe information factors. **Methods/Statistical Analysis:** India has 84% of its geological range under precipitous territory. The India is inclined to different catastrophic events, for example, tremor, avalanche, streak surge, and so forth. Individuals and the administration have learnt a great deal from the past encounters and in this manner a procedure of group based debacle administration is being created to deal with the calamities. The examination depends on the information & data gathered throughout the previous years (1970-2016). A list of disaster knowledge factors was first identified through a comprehensive literature review and later semi-structured interviews were conducted among few disaster management practitioners to explore the influence and challenges relating to identify knowledge factors. **Findings:** In view of the connection of one occasion each under the classification of normal and manmade fiascos (avalanches, transport mishaps') it is presumed that these relationships set up that the toll of mischance is ordinarily more than the calamity occasions and there exists a squeezing need to give careful consideration towards overseeing mischance that take substantial toll of the worldwide assets. Among key difficulties, the absence of recognition and cautioning frameworks, the requirement for compelling instruction, preparing and mindfulness raising projects, the requirements' for general refreshing of fiasco related laws, absence of assets for monetary arranging measures, lack of foresight, poor correspondence, poor initiative, and poor institutional game plan were featured. **Improvements:** Group support in a fiasco is a typical marvel in the nations like India. Considering the tremendous capability of group and putting its investment into training in various phases of debacle administration (counteractive action, readiness, relief, reaction and recovery) will surely assist the catastrophe supervisors with making a more secure society. At display there exists no formal and exhaustive database recording the toll of mishaps and the investigation depends on the database gathered from various sources. The paper builds up certain that the extent of the toll of mischances is significantly more than that of fiascos and there exists squeezing requirement for overseeing mishaps.

Keywords: Antecedents of Disaster, Calamity Occasions, Disaster Management, Inevitable Accidents, Mitigation Strategy

1. Introduction

Catastrophe administration can be portrayed as the affiliation and administration of assets and duties regarding

managing every single helpful part of crises, specifically readiness, reaction and recuperation keeping in mind the end goal to reduce the effect of fiascos.

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Cataclysmic event is the repercussion when a characteristic danger like violent wind or surges influences the life of individual. Human helplessness caused by the shortage of fitting crisis administration, prompts money related, ecological, or human effect. The developing misfortune rotates on the span of populace to help or oppose the calamity and their versatility. This fear coordinated as: “fiascos happen when perils meet defenselessness”. A characteristic risk subsequently never culmination in a cataclysmic event in areas without defenselessness, e.g., massive earthquakes in desolate ranges. The term natural has therefore been controverted, as the shifts are not hazards or disasters without human involvement^{1,5}.

Taking after Figure 1 can delineate the entire flow diagram of Disaster Management

“Disaster” starts from Middle French *désastre* and that from Old Italian *disastro*, which thus originates from the Greek pejorative prefix *δυσ-*, (*dus-*) “bad”+ *αστήρ* (*aster*), “star”. The base of the word *fiasco* (“awful- star” in Greek and Latin) originates from a celestial topic in which the people of yore used to reference to the pulverization or deconstruction of a star as a catastrophe².

2. Types of Natural Disaster

2.1 Natural Hazards

Natural hazards is instinctively appearing in the physical phenomena and causing either by rapid or slow onset events, which can be geophysical, hydrological, climatological, meteorological or biological.

2.2 Innovative Or Man-Made Dangers

Innovative or man-made dangers (complex crises, starvation, uprooted populaces, modern mishaps and transport mishances) are occasions that are caused by people and happen in or near human settlements. It can encompass ecological deterioration, contamination alongside mishaps. Technological or man-made risks (complex emergencies/conflicts, famine, displaced populations, industrial accidents and transport accident).

There are ranges of encounters, such as the environment change, unplanned-development, underdevelopment/poverty as well as the threat of p& ‘emics that will shape humanitarian assistance in the future. These provoking factors will result in increased occurrence, complexity and severity of disasters^{1,5}.

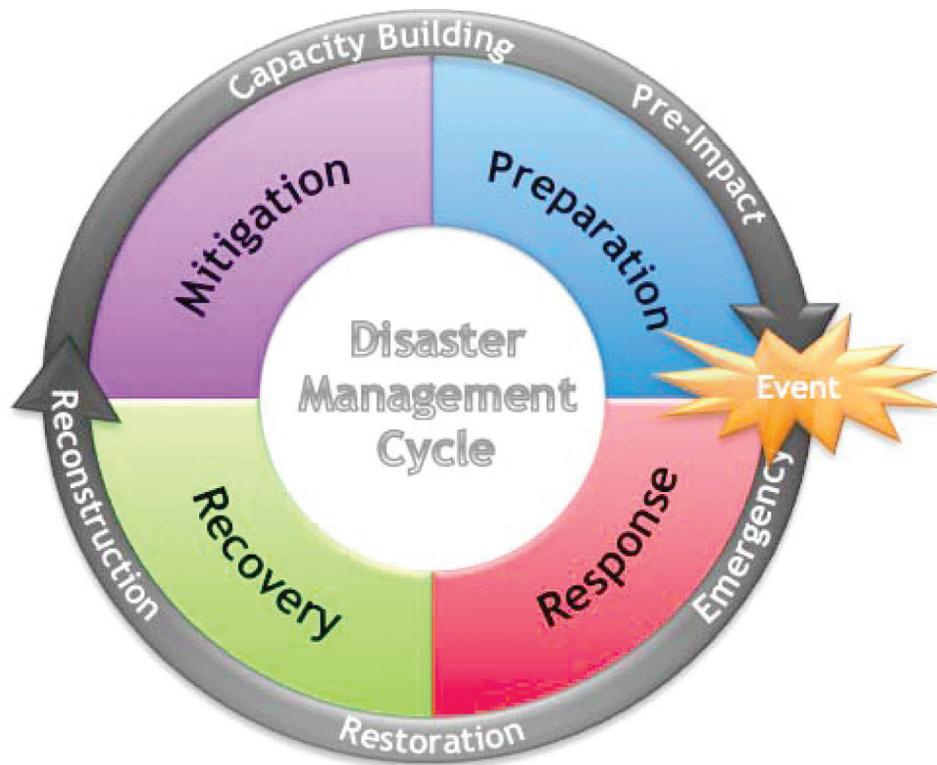


Figure 1. Etymology.



Figure 2. Types of natural disasters.

3. Natural Hazards Summary

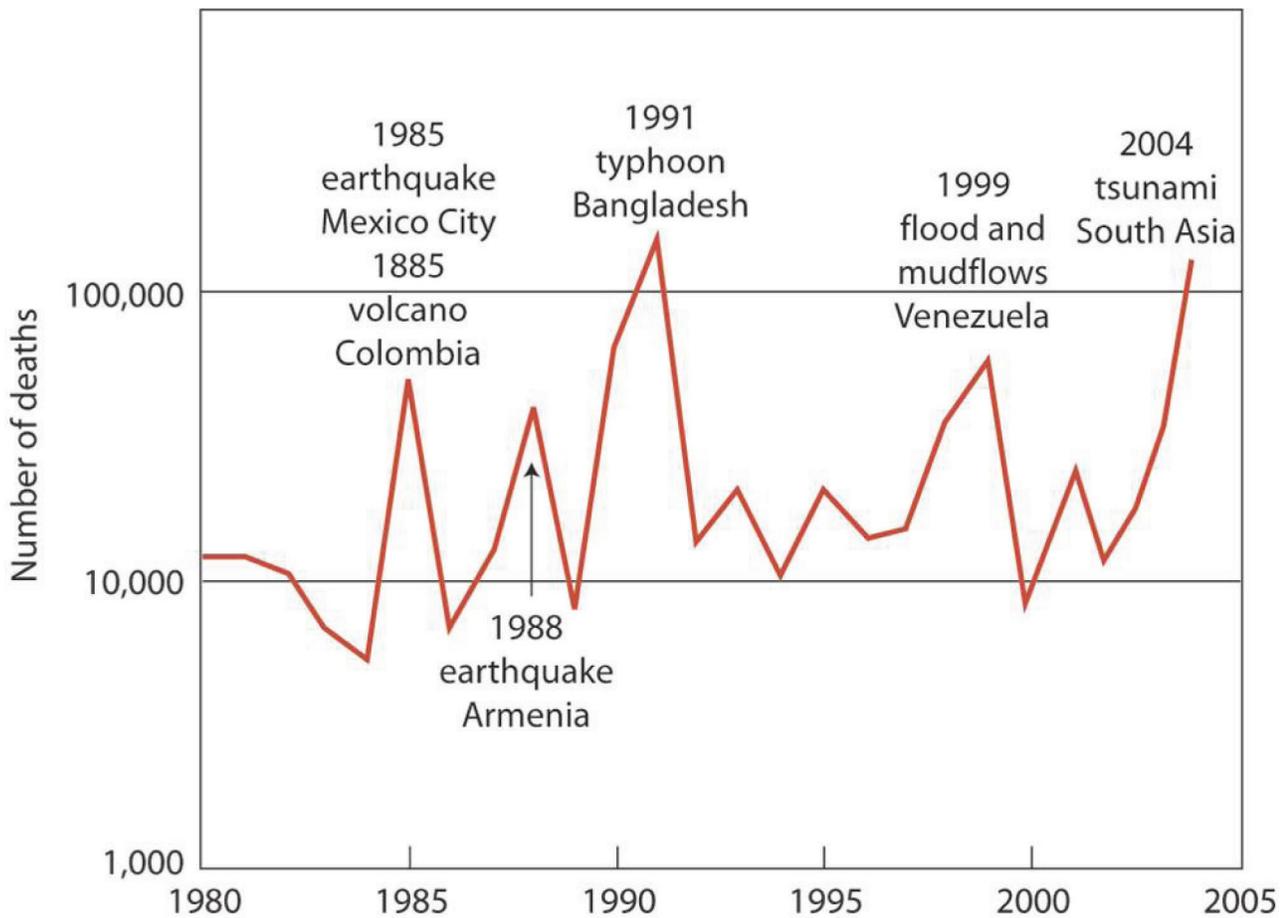


Figure 3. Graph showing the number of deaths per year due to natural hazard events.

Natural Hazards like earthquakes, tsunamis, cyclones, volcanic eruption, avalanches & landslides, are a major cause of fatalities.

- The diagram indicates number of passing's every year because of normal perils. Determined is not withstanding orderly comprehensive mortalities as demonstrated by starvation, age and sickness.
- Every year there are close to 10,000 fatalities caused by standard dangers. In the quantity of substantial scale occasions (seen by the tops on the chart) these number ascents to tens of thousands! (Note the logarithmic scale utilized for the diagram).

Normal Hazards can't be round about, however extent can be taken to reduce the effect they have on the populace. To do this we have to comprehend the procedures required for each kind of occasion and work out individual crisis designs of activity⁴.

3.1 Institutional Outline under the Disaster Management Act

3.1.1 National Disaster Management Authority (NDMA)

The NDMA, as the zenith body for disaster association, is going by the Prime Minister and has the answerability for setting down strategies, plans and standards for DM (and working up their need and execution for guaranteeing brisk and satisfactory reaction to cataclysms). It can perceive the National Disaster Management and DM strategies for the Central Ministries/Departments. NDMA can allow the Departments or masters stressed, to make crisis obtaining of approaches or materials for secure and helping in a crippling fiasco condition or calamity^{1,2}.

3.1.2 The National Executive Committee

The National Executive Committee (NEC) can unite the Union Home Secretary as the Chairperson, and the Secretaries to the GOI in the Ministries/Departments of Agriculture, Atomic Energy, Protection, Drinking Water Supply, Environment and Forests, Finance (Expenditure), Health, Power, Rural Development, Science and Technology, Space, Telecommunications, Urban Development, Water Resources and the Chief of the Combined Defense Staff of the Chiefs of Staff Committee as associates. Secretaries in Ministry of External Affairs,

Earth Science, Human Resource Development, Mines, Shipping, Road Transport and Highways and Secretary, NDMA will be interesting invitees to the clarifications behind social events in the NEC^{1,9}.

3.1.3 State Disaster Management Authority (SDMA)

At the State level, the SDMA, headed by the Chief Minister, will set out specific strategies and plans for DM in the State. By this it will, cover alia demand the State Plan as per the principles figure by the NDMA, fulfill the execution of the State Plan.

3.1.4 District Disaster Management Authority (DDMA)

The District Collector, Deputy Commissioner or District Magistrate will head the DDMA all around, with the picked illustrative of the close-by ace as the Co-Chairperson. DDMA execute as the organizing, masterminding & acknowledging body for Disaster Management at District level and take every last vital measure for DM as per the govern imparted by the NDMA and SDMA.

3.1.5 National Disaster Response Force (NDRF)

The Disaster Management Act, 2005 has made the statutory courses of action for the constitution of the National Disaster Response Force (NDRF) with a conclusive objective of specific response to ordinary & man-made fiascoes. As displayed by Section 45 of the Act, the Force needs to work under the standard superintendence, course and control of the National Disaster Management Authority (NDMA) and under request and supervision of Director General, NDRF. The mass of this Force was expected in 2003, it was basically after the legacy of NDMA that they're training and giving were viably watch ken up. Preferably with the Section 44 (i) of the Act, which says, that NDRF is an unequivocal cutoff focuses and this drive is subtly starting as an entire discernible and dynamic multidisciplinary inclination of the NDMA fit for dealing with an extensive variety of general and man-made challenges. For the goal of specific attestation to a debilitating debacle viably or crises both perceiving and man-made, for example, delivered, radiological, consistent and nuclear start, the Act has named the establishment of a National Disaster Response Force. The general superintendence, course the control of this oblige may be incredibly vested

in and cleaned by the NDMA and the request and supervision of the Force should vest in an officer to be perceived by the Central Government as the Director General of Civil Defense and National Disaster Response Force. Before long, NDRF remain of eight contingents and dispersal might be overseen in planned line. These swarms will be organized at balanced locale as required^{2,6}.

3.1.6 National Institute of Disaster Management (NIDM)

The National Institute of Disaster Management constituted under the Disaster Management Act 2005 has been trusted with the nodal national obligation in regards to human asset change, confine building, research, and documentation and approach progression in the field of cataclysm association. Update from the National Center for Disaster Management of the Indian Institute of Public Administration on sixteenth October 2003, NIDM is interminably advancing to finish its central target to make a fiasco versatile India by making and moving a culture of detestation and openness at all of its stages happening. The NIDM, in collaboration with other research establishments has some headway as one of its enormous pledge, nearby instructing, research, affirmation and change of a national level information base. It will coordinate with a portion of the other information based organizations, and capacity inside the expansive approaches and 'parameters set around the NDMA^{1,2,4,6}.

Rundown of the deadliest catastrophes, which have emerged over the world and around in India as such known till history and in the most recent century, might be seen from the Table 1.

Table 1. Deadliest catastrophe, which have emerged over the world and around in India as such known till history [11]

S.N	Event	Year	Area	Fatalities
1	Bengal Famine	1770,1943	Bengal, Odisha, Bihar	1 Crore
2	Calcutta Cyclone	1737	Calcutta	3 Lakh +
3	Coringa Cyclone	1839	Coringa in & 'hra Pradesh	3.2 Lakh
4	Great Famine	1876-1878	Madras, Mysore, Mumbai, Hyderabad	3 Lakh
5	Latur Earthquake	1993	Latur, Maharashtra	20,000
6	Cyclone	1999	Odisha	10,000
7	Earthquake	2001	Gujarat	20,000
8	Tsunami	2004	Southern India && 'aman Nicobar	2 Lakh
9	Flash Floods	2013	Uttrakh& ', Himachal Pradesh	5000
10	Kashmir Floods	2014	Srinagar	500
11	Earthquake	1905	Kangra	20,000
12	Avalanche	2016	Kashmir	20 Soldiers

4. Why is the Human Component So Analytical, or, Why is it Becoming More Exceptional to Perceive these Events?

- The Earth's population is increasing and therefore, as existing cities it is becoming full and people are searching for advanced places to live in, more and more enters into areas that are prone to hazards.
- Example, today around 65% of the 8 billion inhabitants on Earth lives in cities. Current patterns suggests that by 2030 there will be 10 billion individuals on Earth and 79% of them will be living in urban areas.
- Of all the cities, 48% of them lie on the coast and therefore are prone to severe storm and tsunami destruction.

There are plentiful other examples:

- The edges of volcanoes have extremely rich soils, so agriculturists brush their animals nearer to the volcanic vent with a specific end goal to raise their income.
- Citizens build their residence into peak areas where earth drop fall occur¹⁰.

Truth be told, "WE CANNOT stop the geologic methodology," and "WE CANNOT stops the populace development/extension".

Therefore, we should attempt to diminish (relieve) the risks through:

- Logical Course.
- Populace Proficiency.



Figure 4. Before and after photographs from Phuket, Thailand of the 2004 Boxing Day (26th of December) tsunami.

- Changes in designing, building homes.
- Management plans and hazard response scenarios.

We need to remember that we cannot stop the geologic process (you can't stop a volcano from erupting, or a cyclone from forming), we also cannot stop the population from growing.

We can only pursue the risk to life and ownership.

To happenstance the upcoming hazard we should concentrate to study our attempt to obtain and help prediction future hazards. We need to keep an eye on the hazardous systems and quickly broadcast the information from the researchers to the people.

This will help our aim to MITIGATE the effect of the natural hazards.

5. Mitigation Strategy

- Recognition of potential disaster provoking scenarios and the associated hazard level.
- Examination of feasible consequences for the contrasting scenarios.
- Assurance of potential measures to eliminate the constitutional continuing of the hazard.
- Endorsement of definite alleviative amount and if conformant reestablishment and rehabilitation plans.
- Imparting of expertise with jurisdiction and civilization.

5.1 Example Land Slide Mitigation

An extensive variety of techniques are being utilized to cure torrential slide issues. The perfect elucidation is to direct torrential slide slanted locales. Before acquiring any land or a present structure or building, the purchaser

should get it examined by a geologist or a geotechnical draftsman to survey the potential for torrential slides and further geography related disarrays.

Recorded underneath is some mending approach used when torrential slide slanted inclinations can't be dismiss. There is no attempt that any one system or merger thereof will feasibly settle a moving slant⁶.

5.1.1 Developing Surface and Subsurface Waste

The water is an overwhelming element in mudslides; thriving shell and subsurface exuding at the site can build the concordance of a torrential slide slanted incline. Obvious water should be occupied the torrential slide slanted district by bearing water in a lined waste cast off or sewer pipe to the base of the inclination. The water should be headed away over such a route as to decline enacting, torrential slide neighboring the site. Surface water shouldn't be recognized to lake on the torrential slide slanted inclination.

Ground liquid can be wiped out from the earth using trenches stacked with shake and punctured channels. Swimming pools, water lines, and sewers should be figured out how to expect spillage, and the watering of patio nurseries and vegetation should be kept to a base. Clayey soils and shale's have pneumatic faithfulness and can wind up obviously dangerous to oust.

5.1.2 Scoop the Head

Eliminating the soil and shake at the most noteworthy purpose of torrential slides diminish the weight and can direct or stop torrential slide. Supplementary soil and shake on the torrential slide ought to be expelled to confine a moved torrential slide from forming upslope. Fixing

the grade point at the most noteworthy purpose of the slant can help cement torrential slide slanted inclinations.

5.1.3 Buttrressing

If the group of the torrential slide is at the downside of the slope it can finish off the position over the grip head and forward the base of the inclination. The fill raises the restricting potencies with the breakdown surface in the toe broaden. This, subsequently, thwarts the material in the head from moving near the phalanges. Regardless, if the phalanges are be dominating on the grade, including fill would over-load the soil and shake underneath the phalanges, in this way making a torrential slide mode downslope of the fill.

5.1.4 Building heaps and holding dividers

Piles are metal sections, which have been put in penetrate openings or soils. Suitably arranged piles should enlarge into a competent shake layer underneath the exuberant slide. Wooden bars and utility shafts are not maintained for operation as stores since they deficiency quality and can crumbling. As torrential slides can flood through the gaps yield the loads, shielding dividers are routinely made. Holding limits can be kept by summing slack-

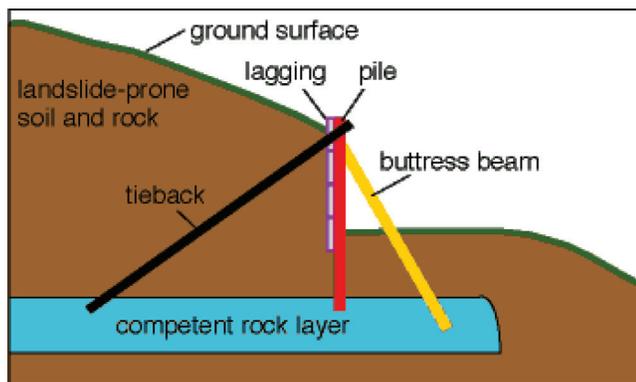


Figure 5. Diagrammatic depiction of a holding divider with tiebacks and prop bars. Tiebacks are same as metal shafts that draw out from the heaps to a skilled shake layer underneath the ground surface. Prop portions are metal removes that are inclined downslope from the loads that shield the stacks from toppling. Slacking incorporates wooden, metal, or solid sections put upslope and adjoining the stacks to fill in the indent.

ing (metal, concrete, or wooden bars) on a level plane amidst the stacks (Figure 5). Tiebacks are long posts that join to the stores and to a talented shake layer underneath the ground surface. Buttrressing bars are inserted at an edge downslope of the stacks to avoid the piles fro tilting. Holding pieces in addition are making of solid, slag squares, shake, railroad ties, yet these may not be liberal duty sufficient to confine exuberant slide tumult and ‘ could crease^{5,6}.

5.2 Expulsion and Substitution

Landslide-inclined soil land shake can be separated and supplanted with more grounded materials, for example, store or sandy soils. As weathering of shale’s would mode have the ability to exuberant slide inclined soils, the clearing and substitution technique must join measures to expel keep weathering of whatever is left of the stone. Mudslide or rockslide essential should never be pushing go down the inclination since it can impel save change of the abundant slide.

5.3 Protecting Vegetation

Trees, grasses, and vegetation can help diminishing the level of water entrance into the soil and can back off the isolating, which was being caused, by surface-water stream, and will activate oust water from the earth. Regardless of the way that vegetation hopeless can’t stop a heavy slide or expulsion of vegetation from an exuberant slide inclined slant area.

5.4 Shake Fall Security

Rock falls are limited by (1) trench at the base of the stone presentation, (2) steel work structure, and (3) solid catch dividers which will moderate errant rocks which have been separated free from the stone outcrop. In restricted situations, slack pieces of shake are snared to bedrock with shake fasteners, long metal poles that are tied down in skilled bedrock and are strung on the outer for tremendous nuts. A metal plate with a middle gap, similar to a vast washer, is set over the finish of the pole where it reaches out from the free square, and the nut is then included and solidified. Once built, it wills therapeutic activities must be reviewed and maintained. Insufficiency of support can root reestablished avalanche development^{3,7}.



Figures 6. Showing rock fall protections.



Figures 7. Showing rock fall protections



Figures 8. Showing debris flow barrier.



Figures 9. Showing avalanche barrier.



Figures 10. Showing avalanche barrier.

6. Remediation/Mitigation Techniques

6.1 Remote Sensing

Landslides and other ground disasters have the tendency to cause huge destruction in the regions where they occur. The number of misfortunes range from structural damage, loss of productivity, scaled down property values, losses in tourism, injury, death, damage to fuel and energy conduits, communication breakdown and highway shutdowns. It also have an conflicting affect on ecological quality by disrupting many natural processes which include increased soil erosion, siltation and turbidity of reservoirs, blockage of stream drainages, and loss of valuable watershed, grazing, and timber lands. Due outcome of the enlarging accident costs, it is therefore important to begun keep an eye on areas prone to such debris flows and earth movement to avoid costly reoccurrences in the forthcoming^{7,9}.

To figure, where shielding frequency are significant, scientists harvest landslide inventory and risk assessment maps for many areas in the United States and Canada. L and slide studies are challenging to scientists, however, as they do not splurge a clear contact among magnitude

and frequency. As an outcome, scientists are continuously relying on satellite data to help estimate the risk of forthcoming landslide occurrences. This reality incorporates:

- The Thematic Mapper.
- Synthetic Aperture Radar (SAR).
- SAR Interferometry (INSAR).
- Radarsat-1.
- European Remote Sensing Satellite (ERS).
- NASA's Shuttle Radar Topography Mission (SRTM).

6.2 The Thematic Mapper (TM)

Computes solar radiation emitted by Earth's surface by making it a useful tool for land cover mapping and judgment. The downside to the TM is its dimensional resolution and considered too coarse to correctly figure out land slide characters^{7,9}.

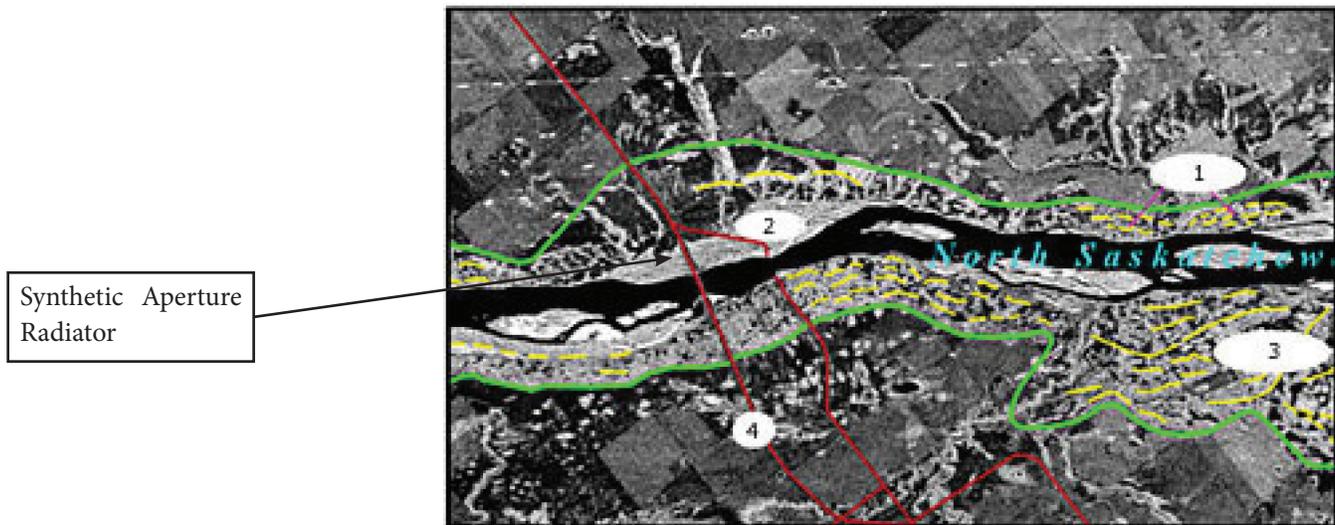
6.3 Synthetic Aperture Radar (SAR)

Analyzes the strength of the convey radar signals that sends out and diversify back. SAR develops images with clarity at a larger spatial resolution than the TM, making it more supportive application. SAR is also rigged to bring in pictures as inclement weather during the night. "Fabricated crevice radar supplements photographic and

other optical imaging competency by virtue of the less weight on time-of-day and ecological conditions, subsequently of this unprecedented response of scene and social absorptions to radar frequencies.” As found in Figure, SAR produces images with more essential detail and assurance, which consider it to be specific beneficial for mapping the geomorphology of torrential slides (Sia Corp., 2005)

Linking pictures from the two different sources, it is feasible to produce a third image that combines features limited of the two instruments. The outcome is topographic details that are effective in producing high-quality land slide maps as is seen in Figure 11. This study is currently called image fusion and is now used frequently in the field of geologic mapping and geo-hazard valuation.

Other technique, which is helpful to scientists/researchers, is SAR interferometry (INSAR). INSAR helps by resulting whether two discrete signals that transmit come back from one another if in fact they come back with different results, this will leads to the result that an article is moving. It clearly makes INSAR imagery a key important technique used to monitor landslide motion as well as its ability to produce detailed contour maps (NPA, 2006). Radarsat-1 produces In SAR images for land slide assessment, while other radar systems, such as NASA’s Shuttle Radar Topography Mission (SRTM) and the European Remote Sensing Satellite (ERS) also have upcoming potential for landslide and other geo-hazard assessment^{3,7,9}.



Figures 11. Showing airborne SAR image (NASA, 2001).



Figures 12. Showing Integrated SAR Image (NASA, 2001)

6.4 Real-Time Monitoring

Constant observing procedures enable geologists to have a definite, direct, thought with respect to how slants are moving and will keep on moving later on. These approaches measure many variables that can lead to landslide events. Beyond the help of monitoring systems landslides cannot be methodically measured for landslide-begun precursors and the possibility for accident and loss increases.

Real-time monitoring systems are considered to help scientists monitor uninterrupted measurements of ground movement and hydrologic situations. The USGS Volcano Hazards Program has been introduced in various avalanche inclined areas with sensors that are observed each second with the information transmitted to a USGS PC each 15 minute. The data from these broadcasts is then graphed and available to those who may of data that includes precipitation, groundwater pressure, slope movement, ground vibration, and overall system power (battery). The sensors are put up in and on the landslide and the substantiation is then transmitted to USGS. This procedure of installing real-time monitors begins with the putting up of solar-powered radio systems that are designed to transmit knowledge collected to USGS computers. This establishment procedure is appeared in Figure 13 is a crucial step in the monitoring process. The telemetry system is designed to act as the evidence con-

duit, essentially gathering all the data and sending it to USGS monitoring station¹⁰.

7. Conclusion

Natural disasters were few and sporadic in the past, but have become more common and devastating recently. This is because of the 'Modern' man including in all sorts of systems, which are in contradiction of natural laws. Mankind should grasp how to escalate Nature and should not hinder with the power of Nature. If we do, it will bring calamity earlier or later. This is one lesson that we haven't learnt so far. Even the up-to-date scientist is sometimes blind to this idea. If you want to slaughter the afforests and build own shack, there will be misery. It rains too much in some part of the country or globe resulting in tides. Climate changes happen in the normal course, but when we tinker with Nature we see that climate changes are unusual and monsoon advances earlier than normal or later than normal months and this results in disaster again. Even the plant present's grain, pulses or fruits out of line and the quality of the products are extremely damaged by our own deeds. Man endures onceover.

Humans should take interest in getting more attentive as possible as and what key precaution's to be taken for its safeguard. It is our social accountability to take care of nature and not pollute or damage it for our own benefits.

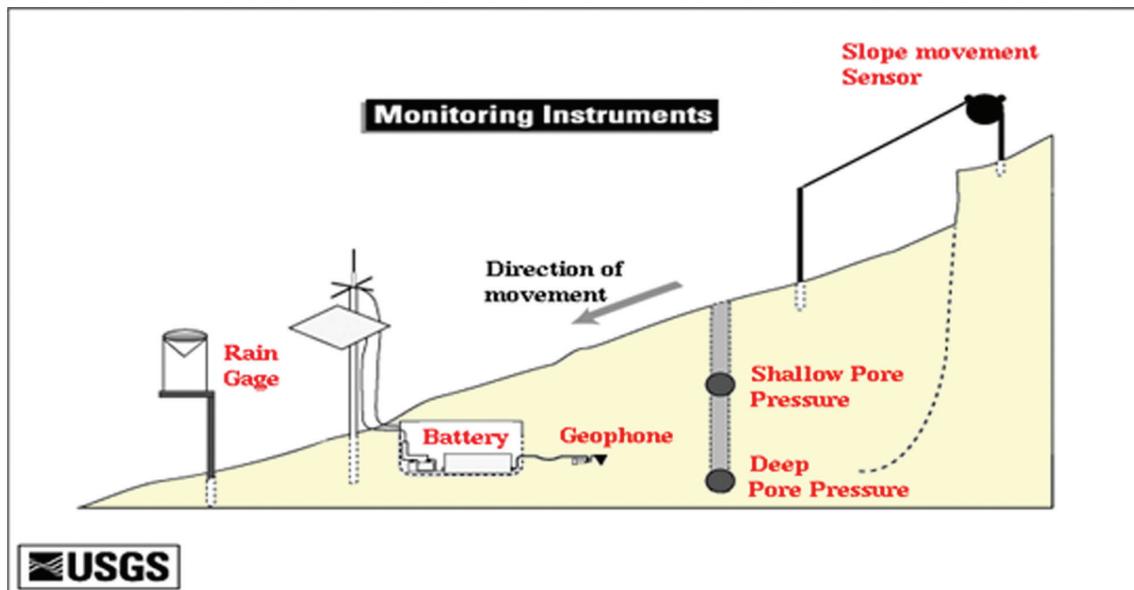


Figure 13. Real-time monitoring instruments.

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