

## HAZARD HOTSPOTS AND THE HUMAN RESPONSE

A natural hazard can be defined as an extreme natural event which impacts upon a population. How a hazard is perceived determines people's responses before, during and after the event and leads to hazard management. Some areas of the world are prone to a multitude of hazards concentrated in the same area, and some experience the same hazard very frequently; these areas can be termed **hazard hotspots**. In these areas a coordinated approach of technology, public awareness and available resources is required to deal with the multiple risks the population faces.

### Responses, reactions and perceptions

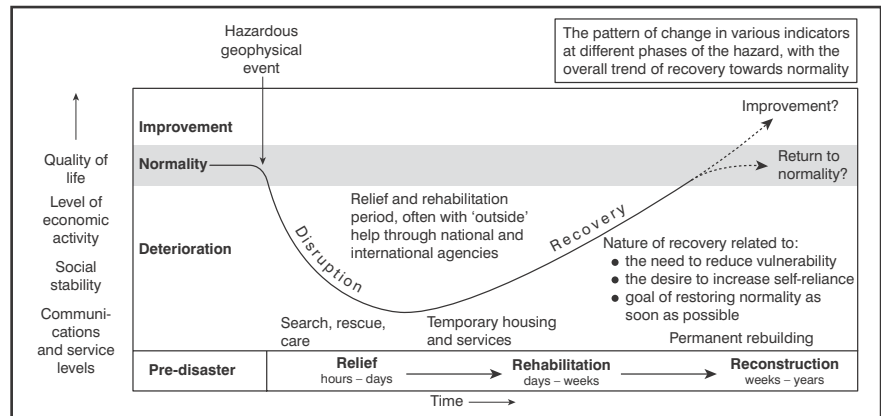
The response to a hazard, whether from the public or authority, will be dependent on the following:

- past experience of the hazard
- economic wealth
- technology and resources
- quality of research and knowledge
- attitude and perceptions of decision makers
- society and culture
- other priorities : jobs, health, national security.

Figure 1 shows the decision process for managing a hazard. A hazardous event is followed by a period of reflection, and a perception of future risk is then formed. Action may then be taken to reduce the impact of the next event.

The ability of the authorities to respond in the long and short term is determined by the physical

Figure 2: Recovery timeline after a hazardous event



Source: Bishop (2001)

and financial resources they have available. More economically developed countries will obviously have more resources available to manage the risk from a hazard and deal with it when it occurs than a lesser developed country. Figure 2 shows how an area ideally recovers from a disaster. The period of disruption is often quite short, but the recovery time can take many years and this is especially true in a less economically developed country.

### Types of response

There are three reactions or responses to a hazard risk:

- prevention and modification: engineering solutions and technology
- modify vulnerability: prediction, public awareness, preparation and planning
- modify the loss: accept the damage, aid, insurance.

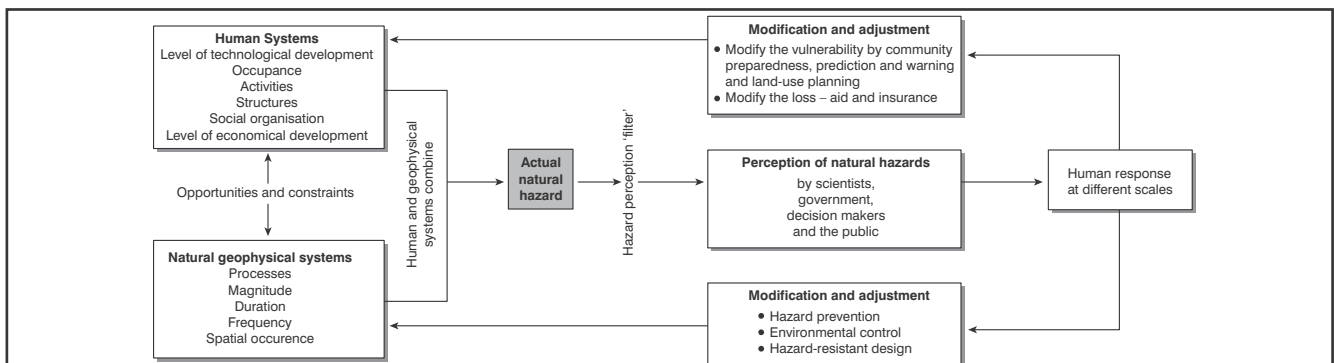
### 1. Prevention and modification

Modifying or preventing an event can only occur in a number of cases. The causal processes of earthquakes, volcanic eruptions, tornadoes and tsunamis, for example, cannot be adapted in any way by people. People can, however, dilute the impact of a hazard by lessening the likelihood of a major event. Flood management and avalanche control are good examples of this. Flood management and avalanche control are good examples of this. Avalanche-prone slopes can have controlled avalanches set off to prevent the larger avalanches. Flooding can be prevented to a certain degree with engineering solutions, but the actual rainfall event or storm surge cannot.

Buildings, bridges, dams, roads and services infrastructure (for water, electricity and gas) can be designed to withstand a certain level of destructive force. Examples are:

- earthquake-proof buildings
- raising houses on stilts in flood areas
- flood defences

Figure 1: Human perception and response to natural hazards



Source: Bishop (2001)

- retrofitting existing structures to improve their defences.

**2. Modify vulnerability**

The ability to predict the occurrence of an extreme natural event is the key to preventing loss of life. However not all events can be predicted to the same degree. With the benefit of satellite and radar technology, large-scale extreme climatic events have become the most predictable. Volcanoes can be closely monitored and some degree of predictability gained, but earthquakes are still unpredictable and have devastating effects over large areas, because we do not know the warning signs.

The key to prediction is recognising the warning signs before an event, and combining them with past experiences, then action can be taken. Without the warning signs then only long-term preparations can be undertaken and not immediate action.

Within a hazard zone the poor, young and old will be the most vulnerable groups. The level of economic development, education and communication technology are also factors. The quality of the following characteristics is dependent on the economic wealth of the country and can reduce the vulnerability of the population:

- planning laws
- building design
- prediction technology and research
- emergency service provision
- aid provision
- communication and education.

Public awareness and planning restrictions can prepare a community for a hazard. Some examples of adapting are:

- not allowing new building on floodplains
- hurricane evacuation plans and centres
- disaster practice days
- tornado warning sirens and shelters.

**3. Modify the loss**

The length of the recovery process for a population depends largely on:

- speed of response from the authorities
- level of economic development in the area
- extent of damage done to the infrastructure of their lives
- morale of the community

Figure 3: Multi-hazard regions within LEDCs and MEDCs

MEDC	LEDC
Japan GDP/capita: \$34,254 <ul style="list-style-type: none"> <li>Volcanoes</li> <li>Earthquakes</li> <li>Tsunami</li> <li>Landslides</li> <li>Typhoons</li> </ul>	Indonesia GDP/capita: \$1918 <ul style="list-style-type: none"> <li>Volcanoes</li> <li>Earthquakes</li> <li>Tsunami</li> <li>Cyclones</li> <li>Wildfire</li> </ul>
California GDP/capita: \$41,663 <ul style="list-style-type: none"> <li>Earthquakes</li> <li>Landslides</li> <li>Wildfire</li> <li>Floods</li> <li>Freeze</li> <li>Drought</li> <li>Smog</li> </ul>	India GDP/capita: \$1042 <ul style="list-style-type: none"> <li>Earthquakes</li> <li>Monsoon floods</li> <li>Landslides</li> <li>Typhoons</li> <li>Severe heat</li> </ul>

Source: adapted from Wikipedia/World Bank (2008)

Figure 4: Declared disasters in California 1954-2007

Declared disasters 1954-2007		Example
Fire	11	2007 October: wildfire: 14 fatalities 2000 homes destroyed. Cost \$1 billion
Freeze	3	2007 January: Arctic cold 75% of USA citrus crop destroyed \$1billion agricultural losses
Severe storms, flooding and landslides	37	2005 January: Floods and rains La Conchita Landslide 9 m high mudslide 10 fatalities
Earthquake	10	Northridge 1994: 72 fatalities 12,500 structures damaged Damage costs: \$12.5 billion
El Nino	1	1998: Floods, severe storms statewide 60,000 people registered for FEMA disaster aid 11,000 evacuated in Northern California Damage costs: \$550 million
Dam/levée burst	5	2006 April: Central Valley South of Sacramento two levée breaks
Tropical storm	1	1997 September: Tropical Storm Nora Landfall Baja California Formed in El Nino year Agricultural damage \$200 million
Tsunami	1	1964 March: Crescent City tsunami Origin: Alaskan Earthquake 2.1-6.3 wave height 11 fatalities Damage: \$2 million (1964\$)

Source: [www.FEMA.gov.us](http://www.FEMA.gov.us)

- types of aid, short and long term
- collaboration between governments and aid agencies.

Financial insurance is a response to living within a hazard zone (mostly

in MEDCs). Money is paid to an insurance company based on the likelihood of damage occurring to a property. In the event of damage occurring, the insurance company pays out for the damage to be

Figure 5: California State Hazard Mitigation Plan

<b>California's State Hazard Mitigation Plan aims</b>
Significantly reduce life loss and injuries.
Minimize damage to structures and property, as well as disruption of essential services and human activities.
Protect the environment.
Promote hazard mitigation as an integrated public policy.
<b>Steps to Hazard Mitigation</b>
Hazard Identification: Location, extent and potential severity. Hazard mapping using GIS.
Vulnerability: Who and what is at risk and to what extent?
<b>Hazard Mitigation Plan:</b> Applies to individuals, businesses, local, state and federal governments.
Implementation of plan: <ul style="list-style-type: none"> <li>• Land use planning</li> <li>• Building codes</li> <li>• Retrofitting (reinforcement of existing structures)</li> <li>• Removing structures from hazardous areas</li> </ul>

Source: www.hazardmitigation.oes.ca.gov

repaired. People who live in very high risk areas will have to pay very high premiums, or may even be unable to get any insurance, as they pose too great a chance of the insurance company losing its money. Insurance can encourage people to take steps to safeguard their homes and businesses from a hazard, as this can reduce their premium.

An individual response can affect just one person, or if taken by the authorities, millions.

Positive responses:

- find a solution
- control the effects
- acceptance.

Negative responses:

- deny its existence
- deny its recurrence
- blame others
- fatalism: 'Its going to happen and there is nothing I can do!'

A group response can result in large numbers of people either working together to reduce their

vulnerability, or putting themselves in great danger by doing nothing and staying put. Pressure from a community leader or the media can strongly influence people's choices when it comes to their own safety.

### Case study – California: MEDC hazard hotspot: authority and population responses

Figure 3 shows examples of multi-hazard regions within LEDCs and MEDCs.

California has a GDP (gross domestic product) which would make the top 10 in a ranked list of the world's countries. It therefore has an economy and infrastructure which is developed and technologically advanced. California is a multi-hazard region and has proven recent vulnerability to earthquakes, landslides wildfires and flooding (Figure 4). It also has future hazard potential from global warming and tsunamis.

#### Why is California a multi-hazard hotspot?

Between 1954 and 2007 California experienced 72 declared disasters which required help from the Federal Emergency Disaster Agency (FEMA).

California lies on a conservative plate boundary between the North American and Pacific tectonic plates. The San Andreas fault system is linked to movement along this boundary and has produced numerous serious earthquakes, eg San Francisco 1906 and 1989, Northridge 1994. A more frequently destructive hazard is wildfire, as 35% of the state is pine forest which under drought conditions poses a significant wildfire hazard. In the mountains and coastal areas, poorly vegetated steep slopes are prone to landslides. Flash flooding can occur following thunderstorms and snow melt in the spring. A further hazard is the man-made smog of pollutants which hangs over the city of Los Angeles under certain weather conditions.

#### Authority response

California has a **State Hazard Mitigation Plan** which covers man-made and natural hazards. Hazard mitigation is defined as is 'any action taken to reduce or eliminate

Figure 6: Fire Management Assistance Declarations: Help requested from FEMA to provide resources

California: Fire Management Assistance Declarations	
2002	12
2003	16
2004	20
2005	7
2006	8
2007	17
2008	10 (as of July 15)

Source: www.fema.gov.us

the long-term risk to human life and property from natural hazards' (FEMA).

Californians have a high standard of living and high expectations of the authorities to protect them. The state can provide resources to a certain extent, but essential to the plan is the willingness of the population to recognize the risks and take action to reduce their own vulnerability (Figure 5). There is an extensive public information campaign to raise awareness and prepare the population for the multi-hazard risks they face.

#### Focus on wildfire in California

California is the most wildfire-prone state in the USA, with 8 million people living in wildfire risk areas within 2500 communities. California's climate and 'chaparral' vegetation make it more prone to wildfire than any other state in the USA. (Chaparral vegetation = deciduous shrubs and trees less than 2.5 m tall, indicative of Mediterranean climates.)

Protecting the public demands that fires are extinguished immediately; this tends to allow the build-up of scrub which would normally be burnt in the natural cycle of wildfire burns which occur naturally and are vital to the health of the ecosystem. Ironically, saving this vegetation from wildfire actually increases the amount of material available to burn, but the needs of the population require that fires are controlled. Figure 6 shows how many times California has called upon FEMA for assistance; the numbers of fires will run into hundreds and occasionally thousands per year.

### Californian state response

The California Fire Plan is devised to reduce the risk, severity, frequency and size of fires, besides reducing the cost of firefighting, and promoting a healthy ecosystem. Firefighting is organized on three levels: county, state and national. If an individual county's resources cannot cope then the California Department of Forestry and Fire Protection (CAL FIRE) can request further resources from state, national and even international resources. The governor of California (currently Arnold Schwarzenegger) can, in extreme circumstances, declare a state of emergency which gives him further authority to release resources such as the National Guard.

Within the plan communities are encouraged to form Community Wildfire Protection Plans and Fire Safe Councils which pool resources, identify risk areas and undertake fire risk reduction work such as brush and scrub clearance. They also advise home-owners on how to reduce the vulnerability of their house to fire, for example by creating **defensible space**. This a 100 ft (30 m) zone around a building which is cleared of vegetation which could fuel a fire. The zone provides an area for firefighters to fight a fire and save the building. Communities can receive funding from the state and national governments to fund work.

Figure 7 shows some of the advice offered to the home-owner to help mitigate against wildfire in California from the Fire Safe Council. The Governor of California is also proposing a 2.8% surcharge on new home-owners' building insurance, if they live in a high-risk zone, to meet the costs of firefighting in the state.

### Population response to wildfire

Recent surveys of Californians who live in wildfire risk zones have shown that a familiar, visible and understood risk is less likely to cause concern than a new, poorly understood risk. The importance of the quality of lifestyle, climate and beautiful surroundings can make it difficult to imagine anything bad happening in California. So people may prepare for but still underestimate the risk that the fire threat poses, because they feel safe. A reliance on mitigation technologies and a faith in the state to protect their lives and homes is also likely.

Figure 7: Creating defensible space public information

### Get ready for fire season – get defensible Space

- Remove all flammable vegetation around all structures. State law requires a minimum of 100 feet of clearance, but check with your insurance agent to see if they require more.
- Trim trees so branches are 6 feet from the ground and 10 feet from your chimney.
- Remove branches overhanging your roof.
- Call your utility company for help with trees near power lines. Never trim these yourself.
- Remove any dead trees.
- Cut weeds and dead grasses 6 inches or shorter.
- Always work early in the morning and make sure your power tools have spark arresters to prevent equipment-caused fires.
- Stack woodpiles at least 30 feet from all structures.
- Locate LPG tanks at least 30 feet from any structure; maintain 10 feet of clear space around the tanks.




Need help?  
Contact your local **Fire Safe Council** to learn about their chipping, home consultations and other programs that can help you become fire safe.

Find a council near you by going to  
[www.firesafecouncil.org](http://www.firesafecouncil.org)

Source: [www.firesafecouncil.org](http://www.firesafecouncil.org)

After the 2007 Californian wildfires two responses to the fires emerged. The first response, called 'post-exposure letdown', occurred in people who were in close proximity to the fires. Typical perceptions of the risk would be 'lightning doesn't strike twice', 'the worst is over' and 'it was a one-off'. These people tended to not do much to prepare themselves for the next fire. The second response, 'post-exposure wake-up call', was found in people not near a recent fire. They were more likely to clear scrub, prepare shelters and move away (Source National Science Foundation).

### Conclusion

A hazard is a function of physical events, man-made factors, human awareness and strategies to cope. California has many potential hazards, but is probably one of the global regions best equipped to cope.

### Resources

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Park, C. (1992) *Environmental Hazards*, Nelson Thornes.

## FOCUS QUESTIONS

- 1 What is a hazard hotspot?
- 2 (a) What are the main factors determining a regions response to hazard risk?  
(b) What are the responses to hazard risk and to what extent do they depend upon level of economic development?  
(c) Explain the importance of hazard perception in responding to a hazard.
- 3 (a) Why is California a hazard hotspot?  
(b) Using the example of any relevant hazard, examine the strategies California uses to mitigate against disasters ([www.hazardmitigation.oes.ca.gov](http://www.hazardmitigation.oes.ca.gov) will help you).