

Accident-Related Disasters

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Module 5: Accident-Related Disasters

Forest Fires, Urban Fires, Mine Flooding, Oil Spill, Major Building Collapse, Serial Bomb Blasts, Festival Disasters and Fires, Electrical Disasters and Fires, Air, Road and Rail Accidents, Boat Capsizing, Village Fire - Definition, Cause, Types, Safety Precautions.



Forest

Land with a tree canopy cover of more than 10 percent and an area of more than 0.5 hectares.

- **Reserved Forest (RF):** An area notified under the provisions of Indian Forest Acts or the State Forest Acts having full degree of protection. In Reserved Forests all activities are prohibited unless permitted.
- **Protected Forest (PF):** An area notified under the provisions of Indian Forest Act or the State Forest Act.
- **Unclassified Forest (UF):** An area recorded as forest but not included in reserved or protected forest category. Ownership status of such forests varies from state to state.



Fire evolved from the Greek word “pyra” meaning growing **embers.**

Fire is a rapid chemical reaction called combustion. It involves fuel, oxygen, and heat.

Forest vs. wild fire

Forest fire refers to an uncontrolled blaze burning in an area dominated by trees

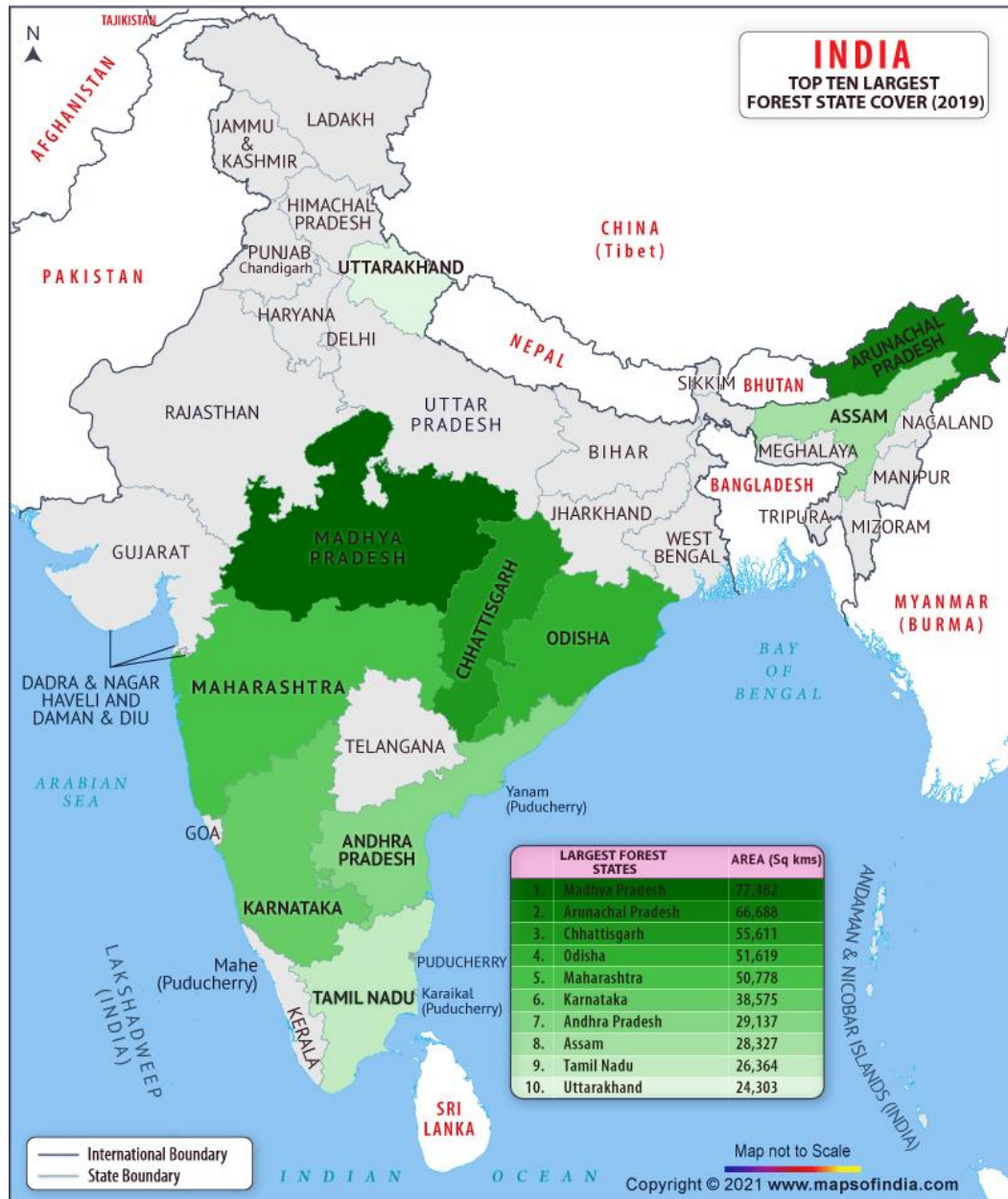
Often occurs in forests with a build-up of dry leaves, twigs, and branches (duff layer) which act as fuel

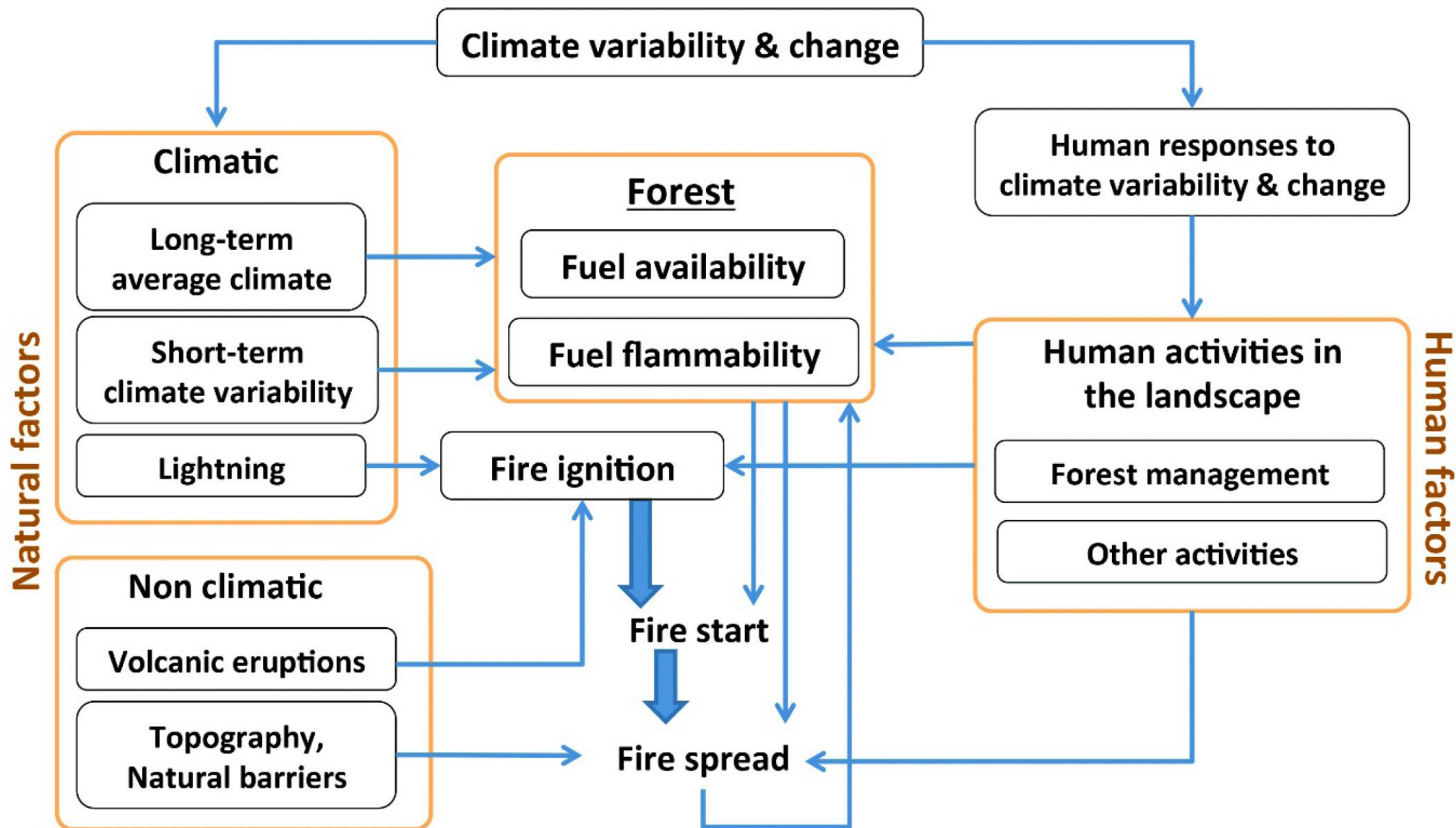
Can be ignited by lightning strikes, human activity, or natural causes

A wildfire is an uncontrolled fire that burns in the wildland vegetation, often in rural areas. Wildfires can burn in forests, grasslands, savannas, and other ecosystems, and have been doing so for hundreds of millions of years. They are not limited to a particular continent or environment.

Forest fire and its causes

Natural	Anthropogenic	
	Deliberate causes	Accidental causes
1. Lightning	1 Shifting Cultivation	1 Collection of Non-Timber Forest Produce
2. Friction of rolling stone	2 To flush growth of tendu leaves	2 Burning farm residues
3. Rubbing of dry bamboo clumps	3 To have good growth of grass and fodder	3 Driving away wild animals
4. Volcanic explosion	4 To settle score with forest department or personal rivalry	4 Throwing burning cigarettes
	5 To clear path by villagers	5. Campfires by picnickers
	6 To encroach upon the forest land	6. Sparks from vehicle -exhaust
	7. For concealing illicit felling	7. Sparks from transformers
	8. Tribal traditions/ customs	8. Uncontrolled prescribed burning
		9. Resin tapping
		10. Making charcoal in forests
		11. Extracting wine in forest
		12. Sparks from cooking near the forest
13.		13. Heating coal tar for road construction in forest





Impacts of forest fires

Forest fires can have a devastating impact on both the environment and human communities.

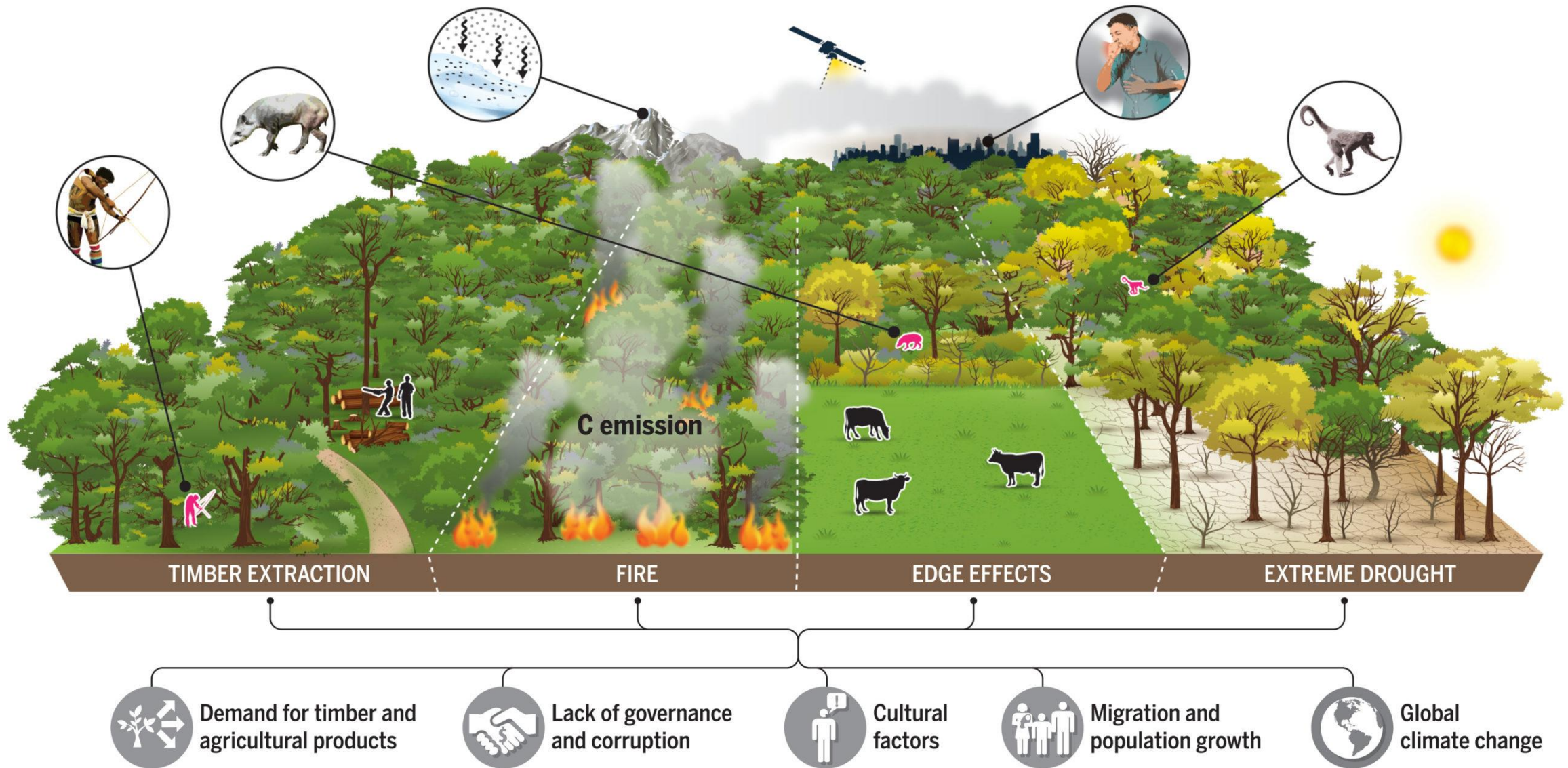
Impact on Environment

Impact on Humans

Impact on Environment

- **Loss of habitat and biodiversity:** Forest fires destroy trees, plants, and undergrowth, eliminating vital habitat for a wide range of animals. This can disrupt food chains and lead to species loss.
- **Soil erosion:** Once the vegetation is burned away, the soil becomes exposed to wind and rain, leading to increased erosion. This can wash away valuable nutrients and topsoil, hindering future plant growth.
- **Water quality degradation:** Erosion from fire-stricken areas can also lead to sedimentation in rivers and streams, impacting water quality for aquatic life and human consumption.
- **Air pollution:** Smoke from forest fires releases harmful pollutants like particulate matter, ozone, and volatile organic compounds into the atmosphere. This can cause respiratory problems, irritate eyes, and worsen existing health conditions.
- **Disruption of natural cycles:** Forest fires can disrupt natural cycles like nutrient cycling and water flow, impacting the overall health of the ecosystem.





Graph showing how the drivers of deforestation cause degradation of remaining forest areas in the Amazon. Image by Alex Argozino/Studio Argozino.

Oil Spill



Oil spill

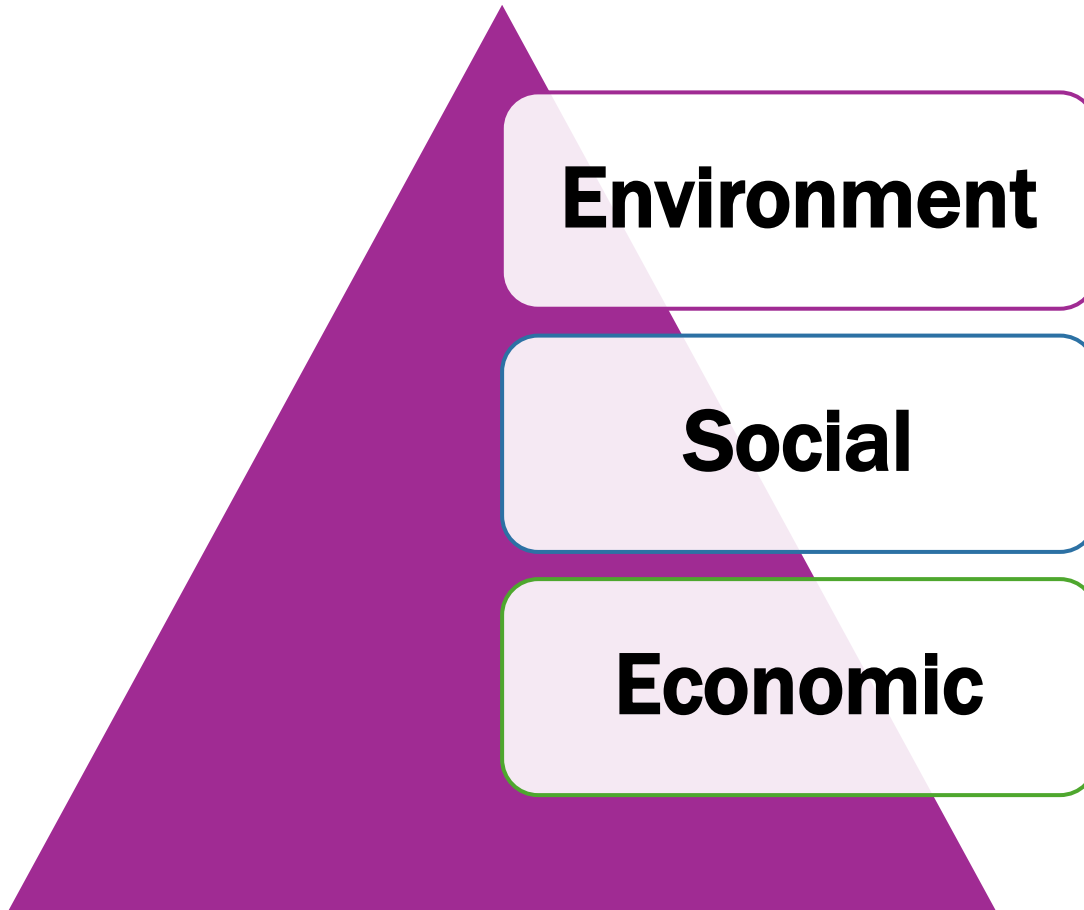
- An oil spill is the release of liquid petroleum, like crude oil or refined products, into the environment, typically referring to spills in the ocean or coastal waters. These spills are caused by human activities and are a form of pollution. While large spills from tankers get a lot of attention, smaller spills from various sources also contribute to the problem.
- Areas with large-scale oil drilling, refining, and transportation activities are at high risk of oil spills.
- These activities can include:
 - Offshore drilling rigs
 - Oil refineries
 - Oil tankers



Causes of Oil spills

- Human error
- Technical faults
- Natural calamities
- Equipment failures
- Pipeline leak
- Planned releases

Impacts of oil spills



Impact on environment

Habitat destruction: Oil can smother sensitive habitats like coral reefs and wetlands, harming the organisms that live there and disrupting the food chain. These delicate ecosystems can take years or even decades to recover from the damage.

Water contamination: Oil can pollute water sources, making them unsuitable for drinking, and recreation, and harming aquatic life. Contaminated water can also affect the health of people who rely on it for consumption or agriculture.

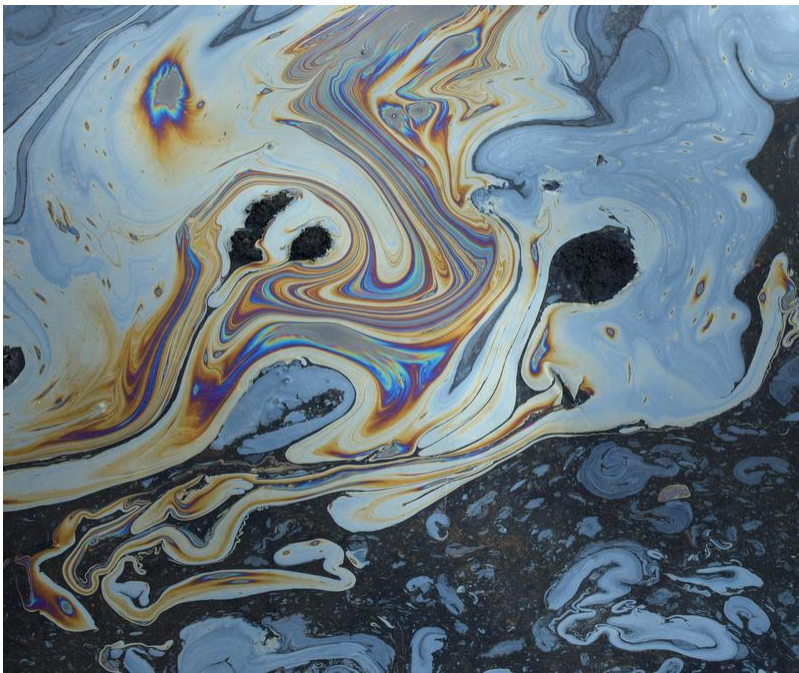
Loss of animal life: Oil exposure can kill animals through inhalation, ingestion, and insulation loss. This can have a cascading effect throughout the food chain, as predators lose their prey and populations

become unbalanced.

Oil slick formation: Oil floats on water, forming a thick layer that can smother shorelines and impede sunlight penetration. Sunlight is essential for marine plants like phytoplankton, which are the base of the ocean's food chain. Reduced sunlight can lead to oxygen depletion and harm countless organisms.

Limited dispersion: Spills near the shore cause quicker damage as the oil doesn't have time to disperse before reaching land. Oil clinging to rocks and beaches can be very difficult to clean up.

Weathering: Wind, waves, and sunlight can break down oil over time, but this process can be slow and can make the oil more toxic in some cases.



Economic impact

1. Lost revenue

Fisheries: Oil spills can contaminate fishing grounds, making them unsafe for harvesting seafood. This leads to lost income for fishermen and disrupts the seafood supply chain.

Tourism: Oil-coated beaches and dead marine life deter tourists from visiting affected areas. This can significantly impact coastal communities that rely on tourism revenue.

2. Cleanup Costs

Containing and cleaning up spilled oil can be incredibly expensive. Costs can include deploying containment booms, skimming oil from the water surface, and treating contaminated shorelines.

3. Compensation

Companies responsible for oil spills may be held liable for damages to the environment and lost economic activity. This can involve paying compensation to fishermen, tourism businesses, and other affected parties.

4. Long-Term Effects

The economic impact of an oil spill can be felt for years, even decades, after the initial event. Ecosystems may take a long time to recover, and some businesses may never fully recover their losses.

Social Impacts of Oil Spills

Loss of Livelihoods

Entire communities, particularly those reliant on fishing and tourism, can suffer economic hardship due to contaminated waters and beaches.

Fishing bans and a decline in tourism revenue can lead to job losses and financial strain.

Health Risks

People involved in cleanup efforts may be exposed to toxic fumes from the oil, leading to respiratory problems, skin irritation, and other health issues.

Communities living near spills may also face health risks from contaminated water or seafood.

Displacement and Disruption

In severe cases, oil spills can force people to evacuate their homes due to health concerns or uninhabitable conditions.

This displacement can disrupt social networks and community life.

Psychological Impact

Witnessing the devastation caused by an oil spill can take a significant emotional toll on residents and cleanup workers. Feelings of helplessness, anger, and anxiety are common.

Loss of Cultural Identity

Coastal communities often have strong ties to the ocean and their way of life.

An oil spill can disrupt these cultural connections and damage the traditional practices of fishing communities.

Strained Social Relations

Disagreements can arise within communities about how to respond to the spill and who is responsible.

This can lead to tension and conflict.

Loss of Recreational Activities

Oil-contaminated beaches and waterways become unsuitable for swimming, boating, and other recreational activities.

This can affect the physical and mental well-being of residents who rely on these activities for leisure and stress relief.

Case study

Deepwater Horizon Oil Spill

- **Date:** April 20, 2010
- **Location:** Gulf of Mexico, Macondo Prospect
- **Cause:** Explosion on the Deepwater Horizon drilling rig
- **Company:** British Petroleum (BP), a multinational oil and gas company.

The Incident

- An explosion ripped through the Deepwater Horizon rig, causing it to sink.
- A damaged wellhead began leaking massive amounts of crude oil into the Gulf.
- The uncontrolled flow continued for 87 days before the well was capped in July 2010.



Impacts

- **Environmental:** The spill is considered the largest marine oil spill in history, releasing an estimated 4.9 million barrels of oil. This devastated marine ecosystems, harming countless species and habitats.
- **Social:** Coastal communities reliant on fishing and tourism suffered economic hardship due to contaminated waters and beaches. Cleanup workers faced health risks, and residents experienced emotional distress.
- **Economic:** The spill caused billions of dollars in damages, impacting the fishing and tourism industries and costing BP heavily in cleanup and compensation efforts.

Regulatory Changes after BP oil spill

The Bureau of Safety and Environmental Enforcement (BOEMRE)

Was criticized for lax oversight before the disaster.

It was subsequently reorganized and renamed, with a stronger focus on safety.

The Well Control Rule

Implemented stricter well control standards to prevent blowouts like the one at Deepwater Horizon.

Requires additional well integrity testing and real-time monitoring.

Third-Party Verification

Mandated independent verification of well control procedures by qualified personnel.



AIR, ROAD AND RAIL ACCIDENTS

Transportation disasters/critical infrastructure

Are defined as any disasters that involve means of mass transport.

- Airplane crashes
- Rail accidents
- Road accidents
- Ship wreckage

They can disrupt the modes, terminals, and infrastructure operations.

Road accidents

- A road accident, also known as a traffic collision or motor vehicle crash, is an unexpected event involving one or more vehicles on a road.
- These accidents can range from minor fender-benders with little to no damage to severe collisions resulting in fatalities.

Table 1.1: Total number of Accidents, Fatalities and Persons Injured during 2018 to 2022

Year	Accidents	% change over previous period	Fatalities	% change over previous period	Persons Injured	% change over previous period
2018	4,70,403	0.2	157593	5.1	4,64,715	-0.6
2019	4,56,959	-2.9	1,58,984	0.9	4,49,360	-3.3
2020	3,72,181	-18.6	1,38,383	-13.0	3,46,747	-22.8
2021	4,12,432	10.8	1,53,972	11.3	3,84,448	10.9
2022	4,61,312	11.9	1,68,491	9.4	4,43,366	15.3

Source: https://morth.nic.in/sites/default/files/RA_2022_30_Oct.pdf

What leads to road accidents?

- **Distracted driving:** Using phones, eating, or talking to passengers diverts attention from the road.
- **Drunk driving:** Driving under the influence of alcohol or drugs significantly impairs judgment and coordination.
- **Speeding:** Driving faster than the speed limit reduces reaction time and increases the severity of an accident.
- **Reckless driving:** Aggressive maneuvers like illegal turns or tailgating endanger yourself and others.
- **Drowsy driving:** Fatigue can be as dangerous as intoxication, slowing reaction times and increasing the risk of accidents.
- **Adverse weather:** Rain, snow, fog, and other bad weather conditions can reduce visibility and make roads slippery.
- **Vehicle malfunctions:** Faulty brakes, tires, or other mechanical issues can lead to a loss of control.

Consequences of Road Accidents

- **Injuries:** Road accidents can cause a wide range of injuries, from minor cuts and bruises to severe spinal cord injuries and even death.
- **Fatalities:** Every year, millions of people around the world lose their lives in road accidents.
- **Economic costs:** Accidents result in significant economic losses due to medical bills, lost productivity, and vehicle damage.
- **Emotional trauma:** Accidents can cause lasting emotional trauma for those involved, their families, and witnesses.

Promoting Road Safety

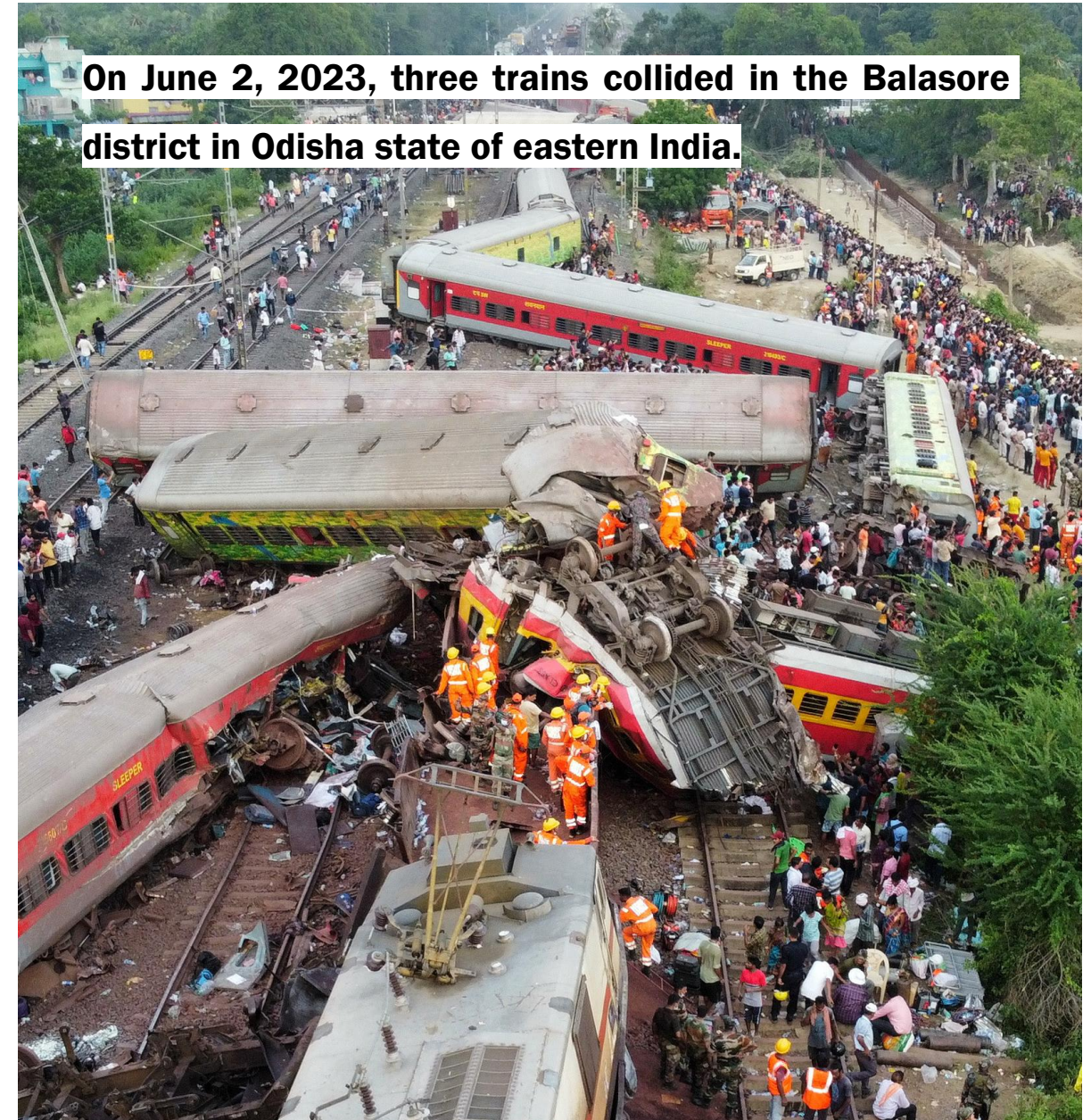
- Implement and enforce traffic laws
- Improve road infrastructure, including signage and lighting
- Encourage responsible driving practices (defensive driving courses)
- Public awareness campaigns on the dangers of distracted driving, drunk driving, and speeding.
- Invest in safer vehicle technologies (automatic emergency braking, lane departure warning)
- Pedestrian and cyclist safety measures (crosswalks, dedicated lanes)

Rail accidents

Railway Disaster is a serious train accident or an untoward event of grave nature, either on railway premises or arising out of railway activity, due to natural or human-made causes, that may lead to loss of many lives and /or grievous injuries to a large number of people, and/or severe disruption of traffic etc, necessitating large scale help from other government/non-government and private organizations.

Types of rail accidents

- **Derailment:** When a train car leaves the tracks.
- **Head-on collision:** Two trains collide head-to-head.
- **Side collision:** Two trains collide on parallel tracks.
- **Level crossing collision:** A train collides with a vehicle or pedestrian at a level crossing.



Causes of Rail Accidents

- **Track defects:** Faulty rails, uneven tracks, or broken sleepers can cause derailments.
- **Equipment failure:** Mechanical problems with locomotives or carriages can lead to accidents.
- **Human error:** Driver fatigue, mistakes by signal operators, or failure to follow procedures can cause accidents.
- **External factors:** Adverse weather conditions, such as heavy rain or snow, can increase the risk of accidents.
- **Trespassing:** People walking on or near railway tracks are at risk of being struck by a train.

Improving Rail Safety

- Regular track inspections and maintenance
- Implementation of positive train control (PTC) technology, which automatically stops trains if they are at risk of a collision
- Investment in modern signaling systems
- Improved driver training and fatigue management programs
- Public education campaigns on the dangers of trespassing on railway tracks

Air accidents

Air accidents are by and large of four types; mid-air collisions, forced landings, crash due to technical snags and air-crash in mountainous terrain due to poor visibility.

While air accidents can occur at any time and at any place, areas within about 30 – 40 kms. radius of airports are most vulnerable.

Experience shows that a majority of air accidents occur either during take-off or landing near major airports where flight paths get congested.

In addition, air accidents also take place at remote inaccessible places like forests, hilly and mountainous regions, high seas, etc

Causes of air accidents are either human failure of pilots, air traffic controllers or technical failures of on board, landing instruments. In rare cases, it may also be the result of terrorist activities.

Improving Air Safety

- Rigorous pilot training and licensing procedures
- Regular aircraft maintenance and inspections
- Advanced avionics and safety technologies, such as ground proximity warning systems (GPWS) and terrain awareness and warning systems (TAWS)
- Strict international aviation safety regulations
- Improved air traffic control procedures

Kozhikode crash on 07 August 2020



Types of man-made disasters and concerned Nodal Ministry

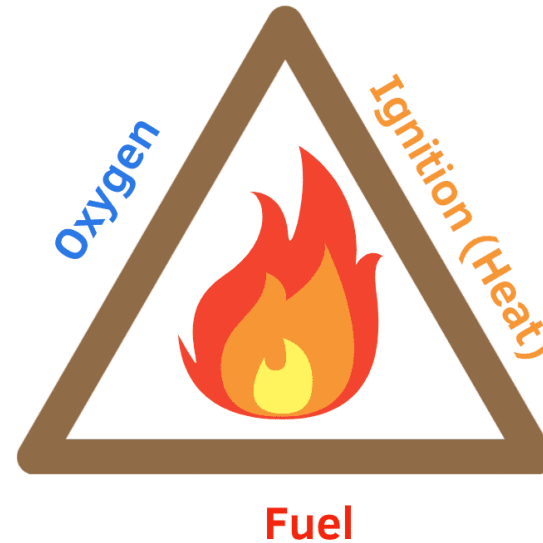
Man-made Disaster	Nodal Ministry
Air Accidents	Ministry of Civil Aviation
Civil Strife	Ministry of Home Affairs
Railway Accidents	Ministry of Railways
Chemical Disasters	Ministry of Environment and Forests
Biological Disasters	Ministry of Health
Nuclear Accident	Dept. of Atomic Energy
Natural Disasters	Ministry of Agriculture

URBAN AND VILLAGE FIRES

What is a fire?

Fire or combustion is defined as a “process involving rapid oxidation at elevated temperatures accompanied by the evolution of heated gaseous products of combustion and the emission of visible and invisible radiation.

In addition to fuel and heat, fires also need oxygen to stay alight.



In addition to a fuel source, heat must be present for ignition to take place.

For a fire to start there must be a material to burn — and this is referred to as the fuel. The fuel for a fire is usually characterized by its moisture content, size, shape, and quantity and this will determine how easily the fuel will burn and at what temperature.



Fire as a hazard

It can occur in workplaces, factories, industries, residential area, areas of mass gathering, etc.

General causes of fires

1. **Faulty appliances and leads:** Faulty equipment and weak wiring cause large number of fires in homes, offices and other establishments. The fire incidents in commercial and institutional buildings are mostly attributed to faulty electrical wiring, short-circuits, failure of electrical equipment, etc
2. **Faulty fuel supply/leak:** Leakage in gas/fuel supply lines cause fires which prove to be difficult to subdue. They may also be caused by acts of arson.
3. **Misuse of equipment or appliances:** Unattended cooking utensils, use of flammable materials for interiors and furniture are major causes of fire outbreaks. Placing flammable articles too close to heat may cause
4. **overheating and fires.** Fires due to bursting of cooking gas cylinders are also common in commercial complexes with kitchens, restaurants or cafes

5. Human error/arson: Human actions like smoking, negligent actions like overcharging and overheating of electrical appliances, lack of knowledge of correct procedures for use of flammable materials cause fires to occur with regular frequency. High density urban living then acts as a catalyst to spread the fire

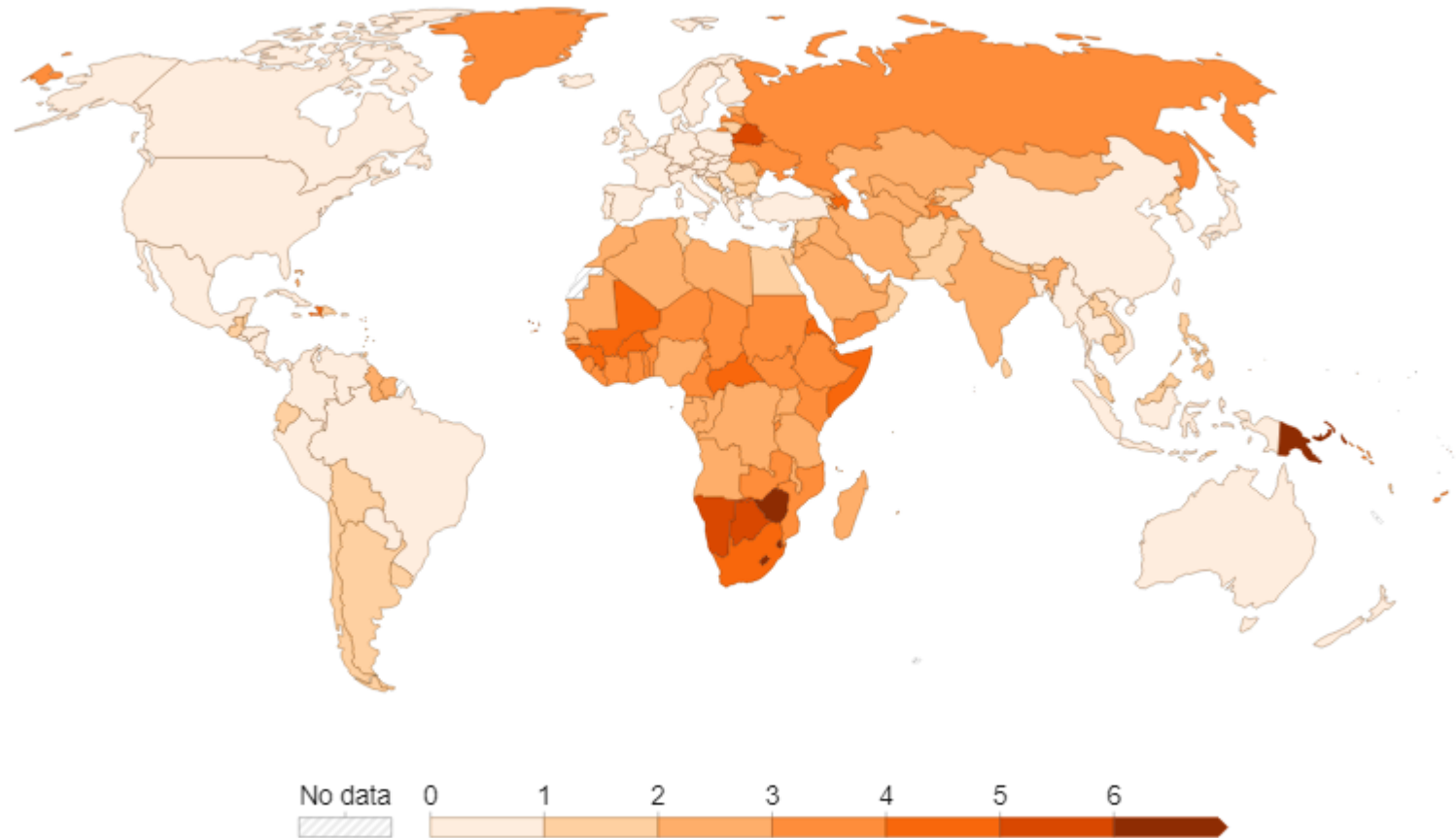
6. Natural and climatic causes: Natural weather phenomena like lightning, extreme heat with low humidity cause fires. Lightning may cause forest fires, which may then spread to inhabited areas. Conversely, human induced fires can also start forest fires. It is estimated that the bush fires of Australia of 2019-20 has destroyed more than 46 million acres, among which 80% of the Blue Mountains World Heritage and 53% of the Gondwanaland World Heritage areas were destroyed. The general loss estimates are 1.3 billion USD of insured claims in addition to huge loss of biodiversity, fauna and livestock. Earthquake induced fires or those caused by volcanic eruptions are other fires caused by natural causes.

7. Accident/collision related fires: Vehicular accidents or collisions may cause local fires which may then spread to other areas. Mine fires are also accidental fire disasters

Death rate from fires and burns, 2019

Annual number of deaths due to fire, heat and hot substances per 100,000 people.

Our World
in Data



Data source: IHME, Global Burden of Disease (2019)

OurWorldInData.org/causes-of-death | CC BY

Note: To allow for comparisons between countries and over time, this metric is age-standardized.



Village vs Urban

What are the challenges in tackling disasters in village vs. urban region



References

Reference materials for each slide are quoted at the right end of the PowerPoint.