True North and Magnetic Pole

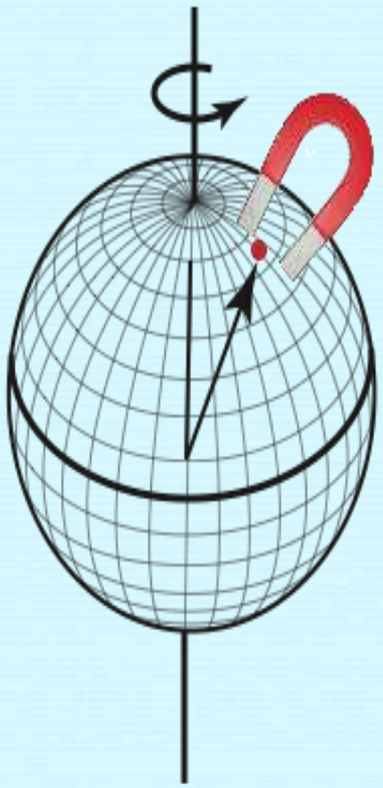
Prof. Erande Manohar R.
Dept. of Geography
Shri Mulikadevi College, Nighoj
Tal. Parner, Dist. Ahmednagar

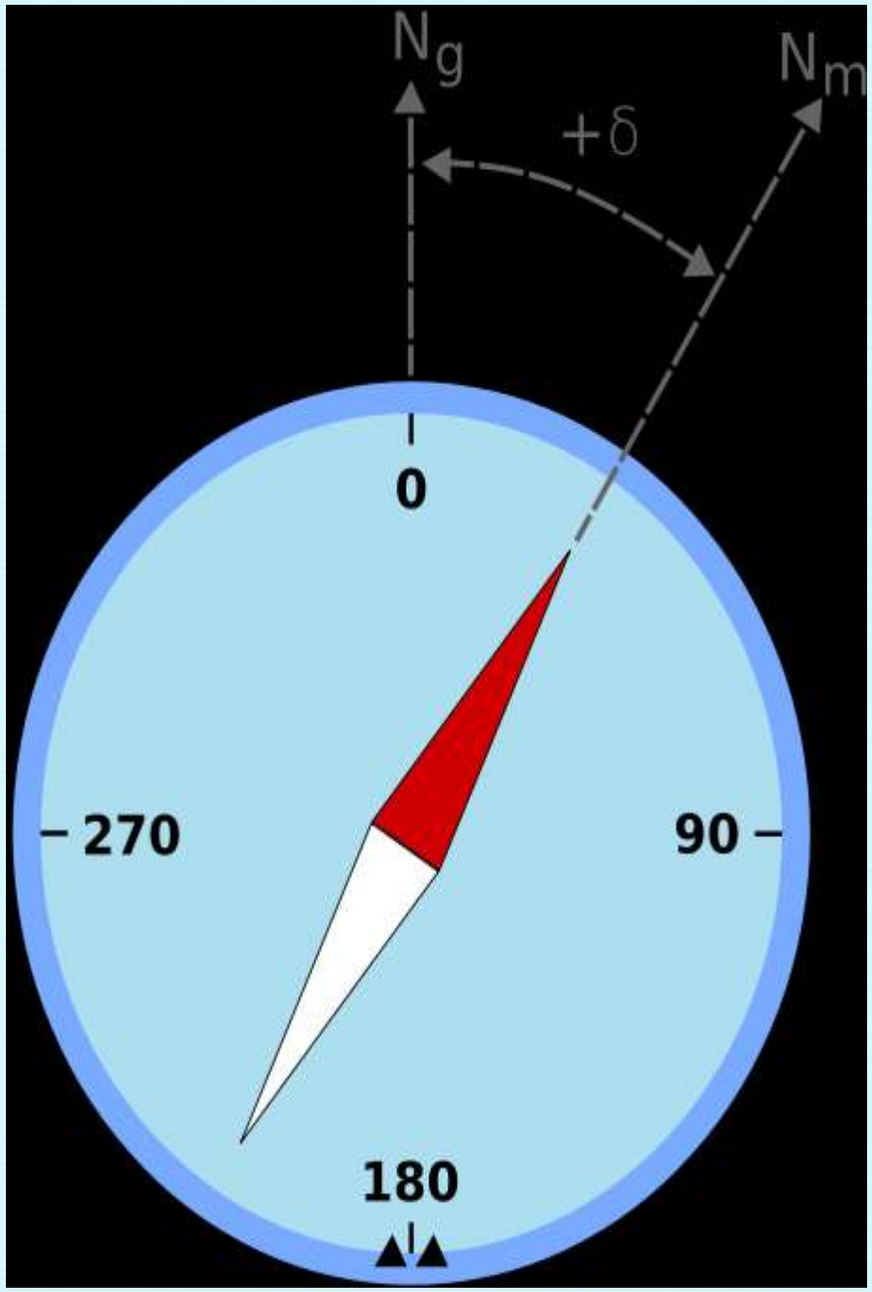
True North

The earth’s axis of rotation

Magnetic North

Where your compass points

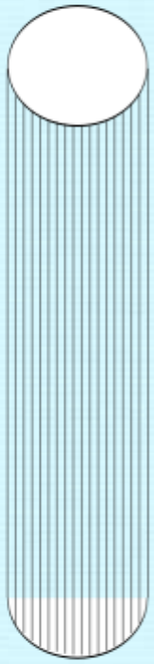




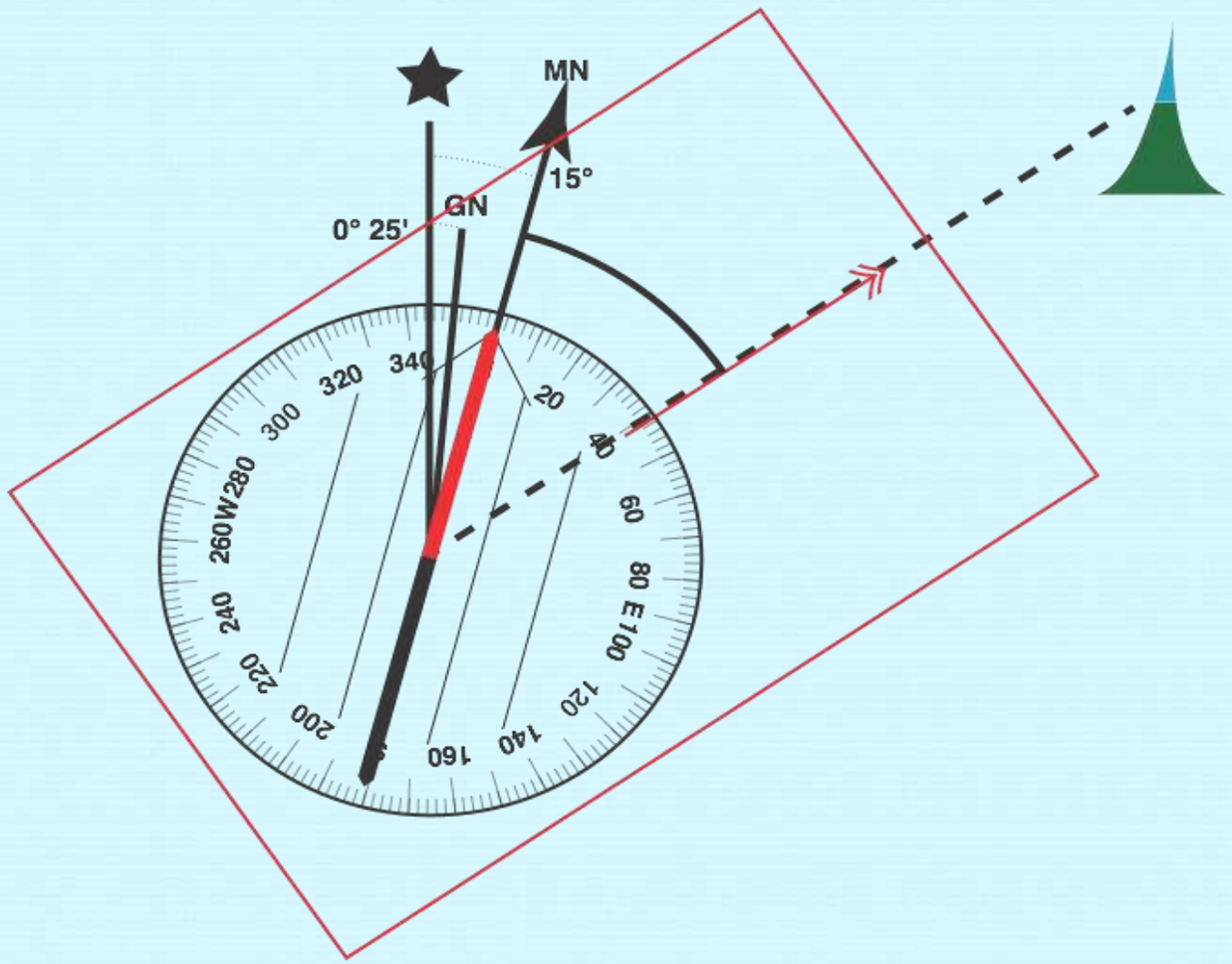
Magnetic declination, or **magnetic variation**, is the angle on the horizontal plane between magnetic north (the direction the north end of a compass needle points, corresponding to the direction of the Earth's magnetic field lines) and true north (the direction along a meridian towards the geographic North Pole). This angle varies depending on position on the Earth's surface and changes over time.

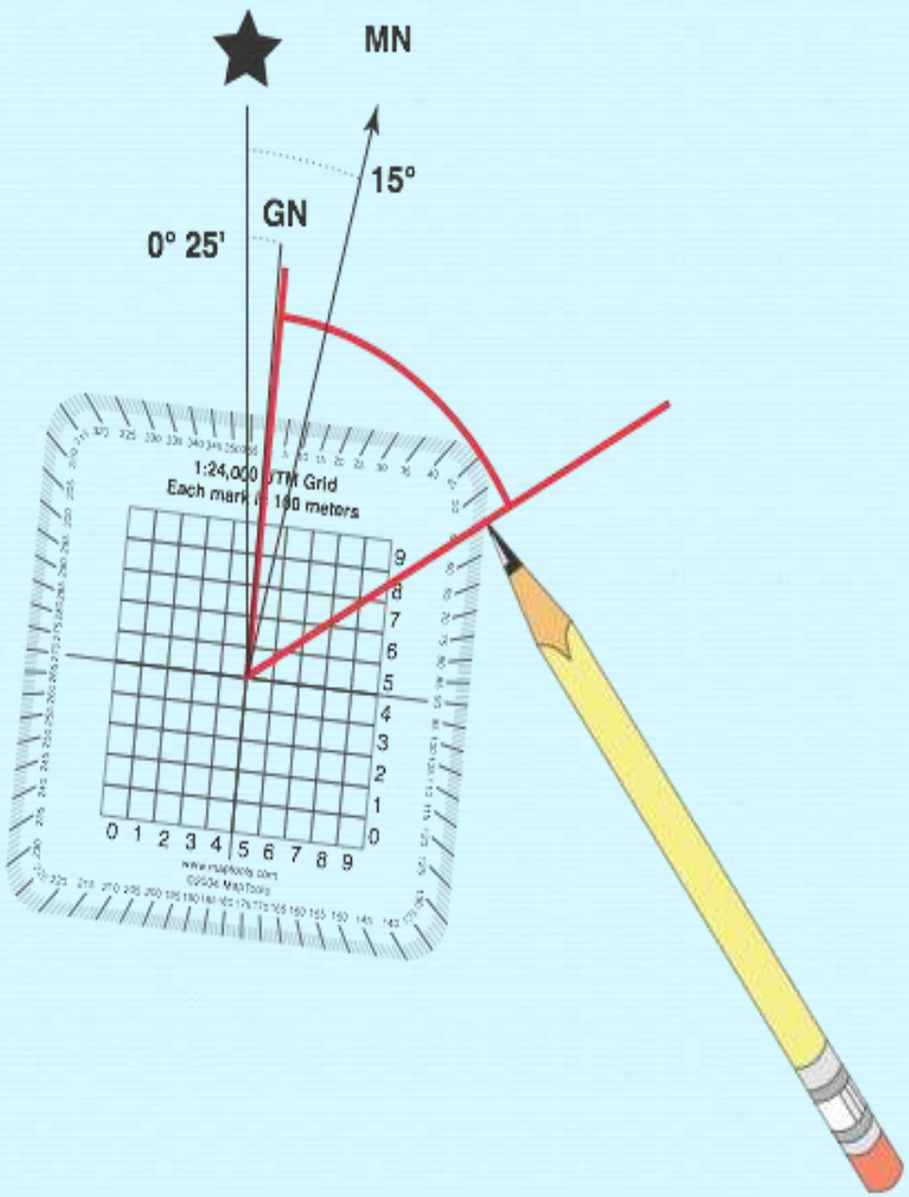
Grid North

Where the UTM grid lines “point” to

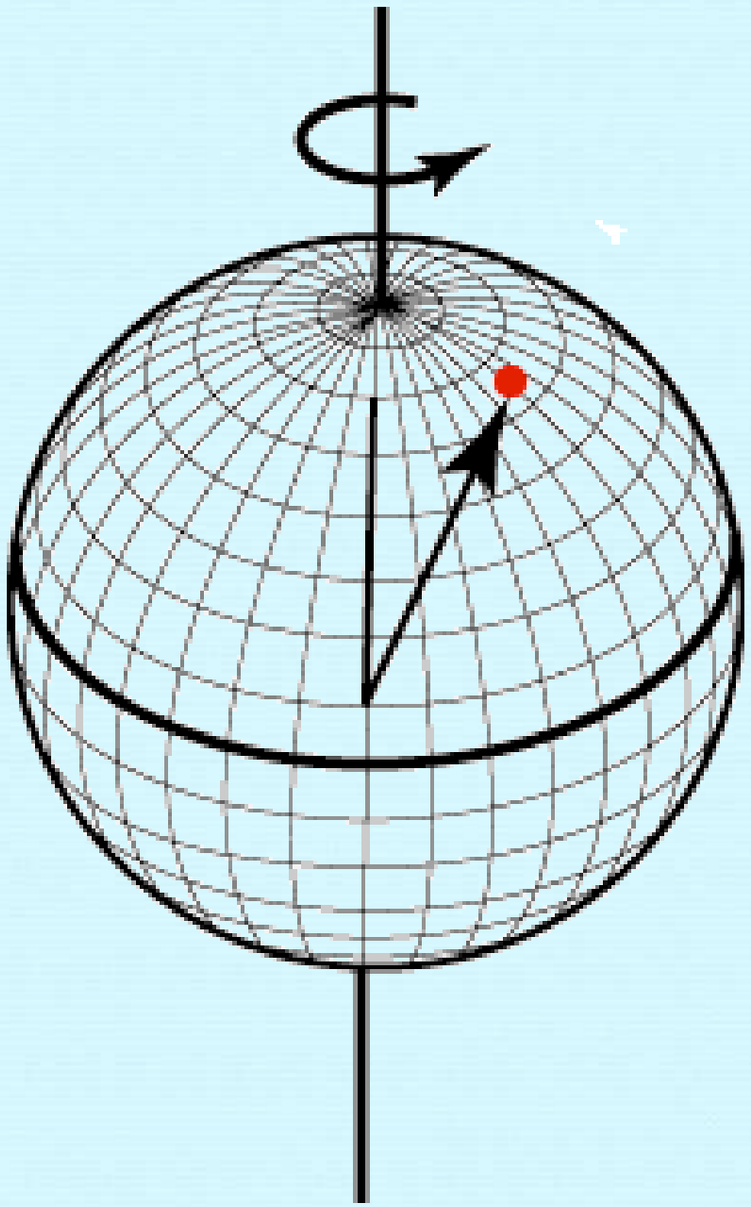


The North Reference you choose determines where 0° is when you measure an angle with your protractor or compass.



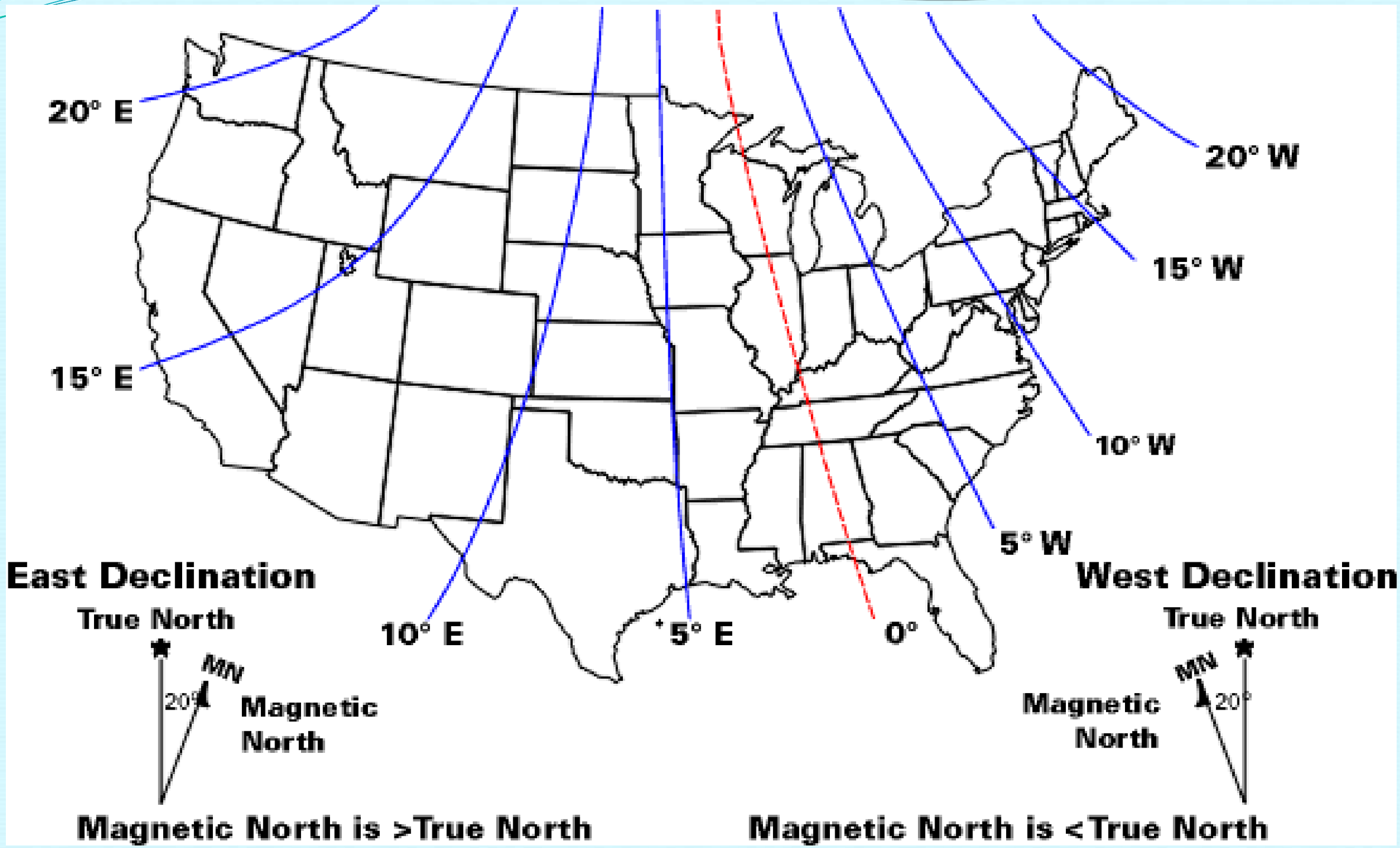


True v.s. Magnetic North



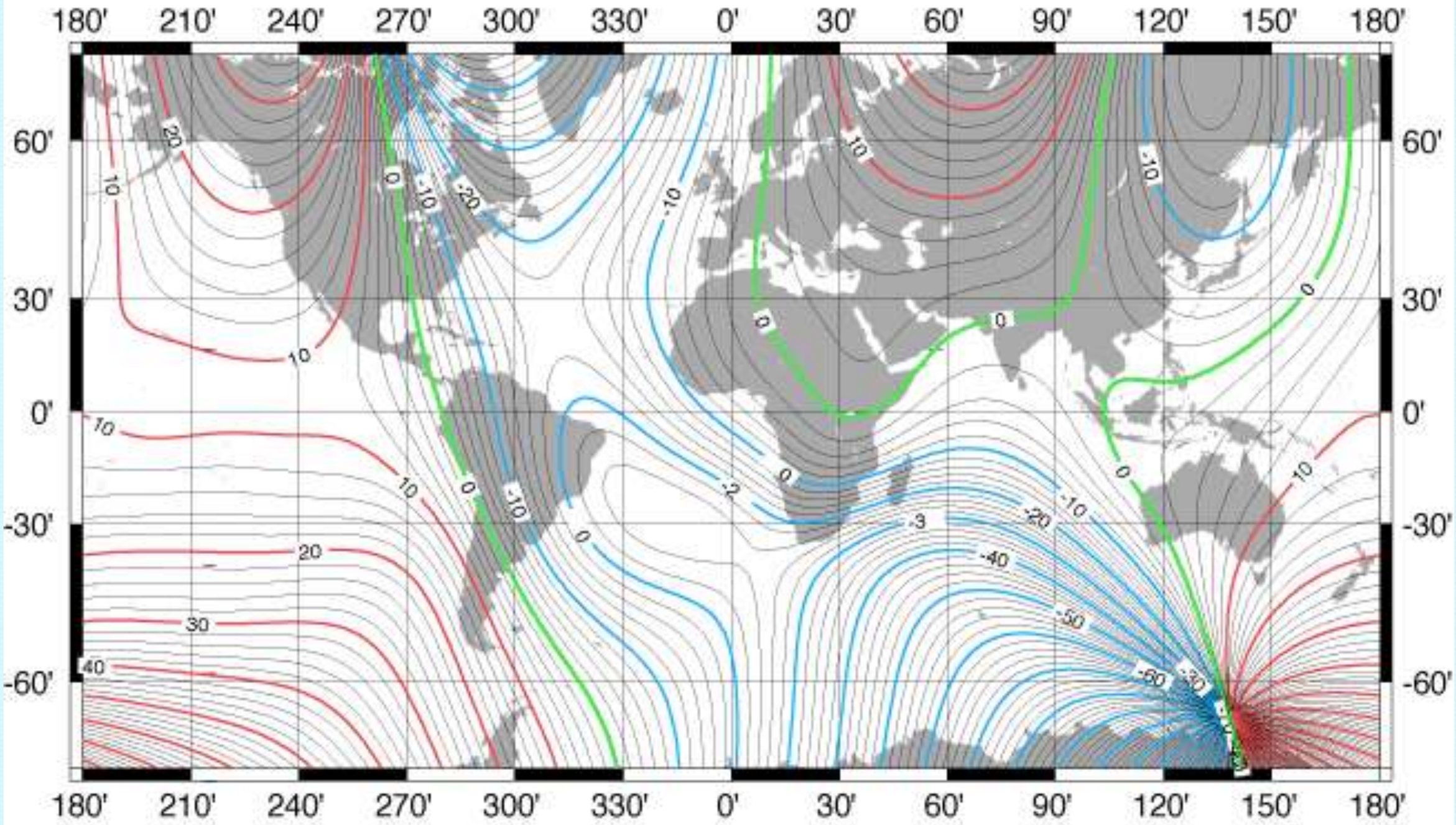
What is the difference here?

- Fruitvale Ave. is aligned with True North.
- So are the edges of parking lots 4 & 5.
- Let’s go take a bearing along the edge of lot 4 and see what we get…

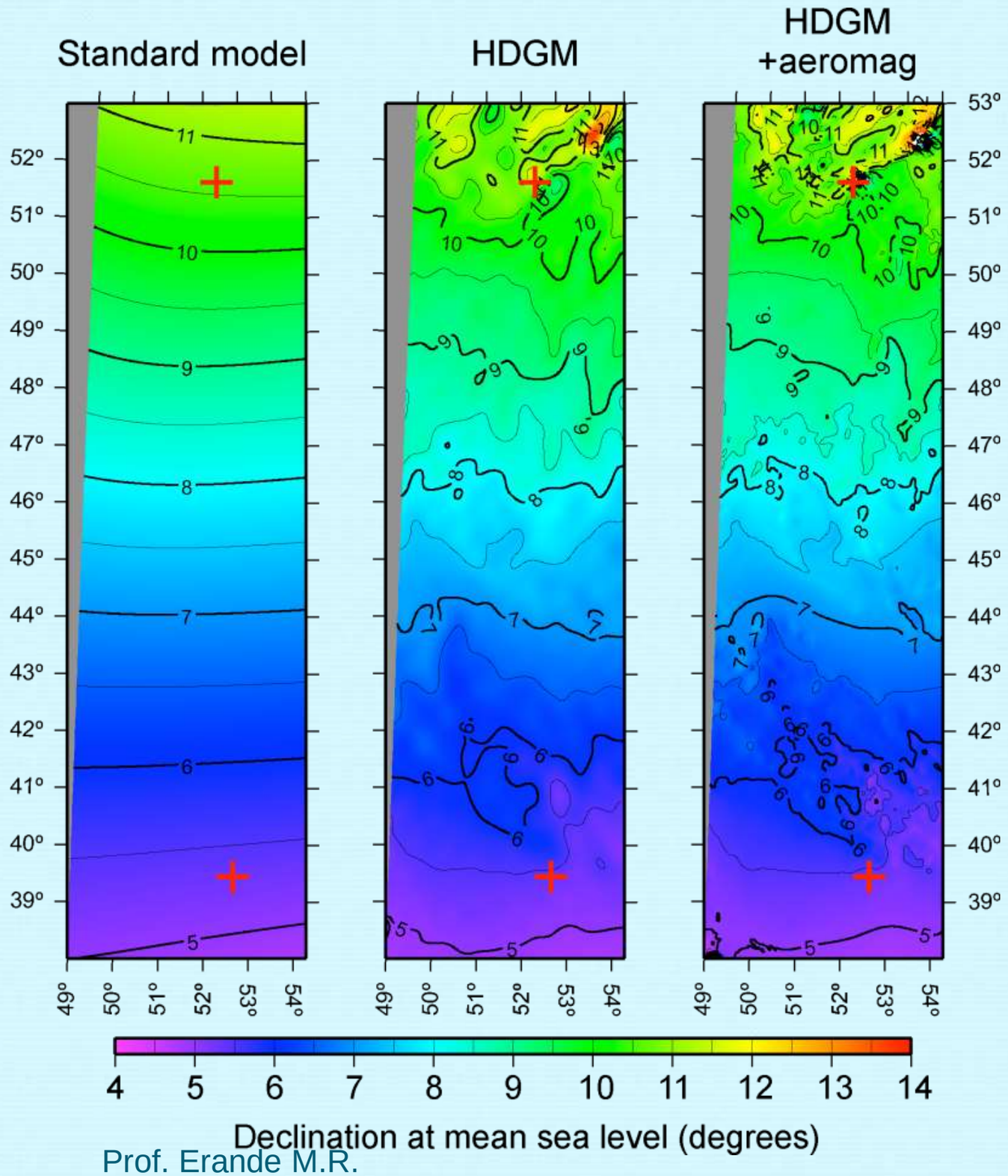

20° E
15° E
10° E
5° E
0°
5° W
10° W
15° W
20° W
East Declination
True North
MN
20°
Magnetic North
Magnetic North is >True North
West Declination
True North
MN
20°
Magnetic North
Magnetic North is <True North

US/UK World Magnetic Chart -- Epoch 2000

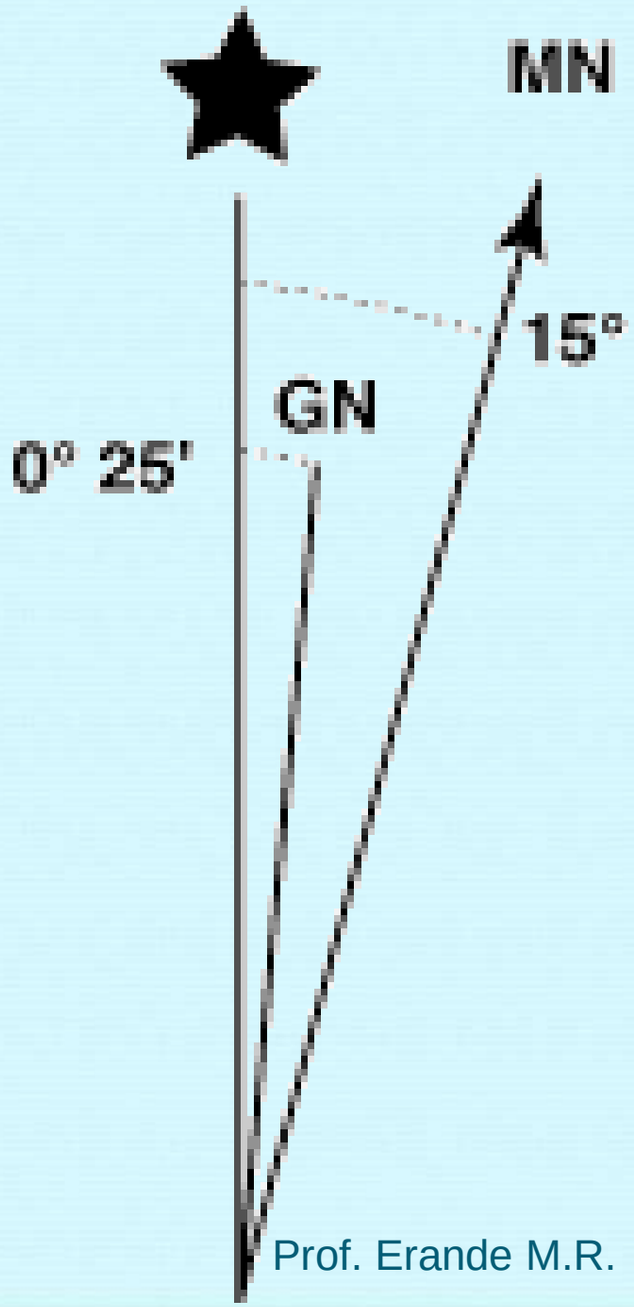
Declination - Main Field (D)

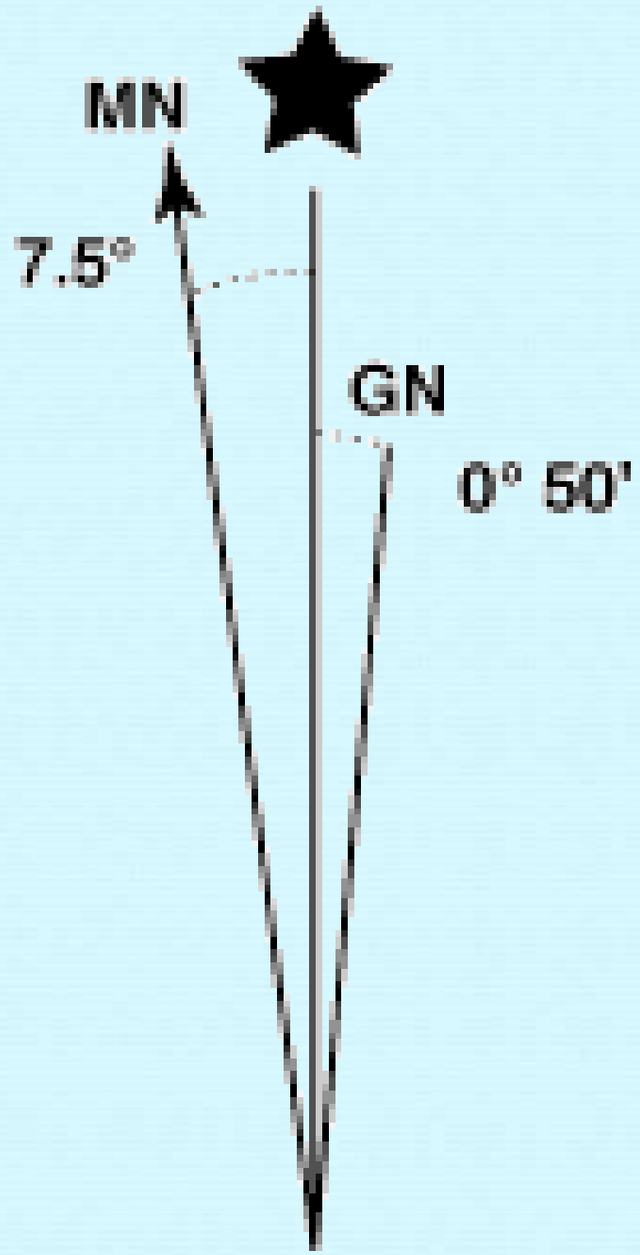


High Definition Geomagnetic Model



Declination Diagrams





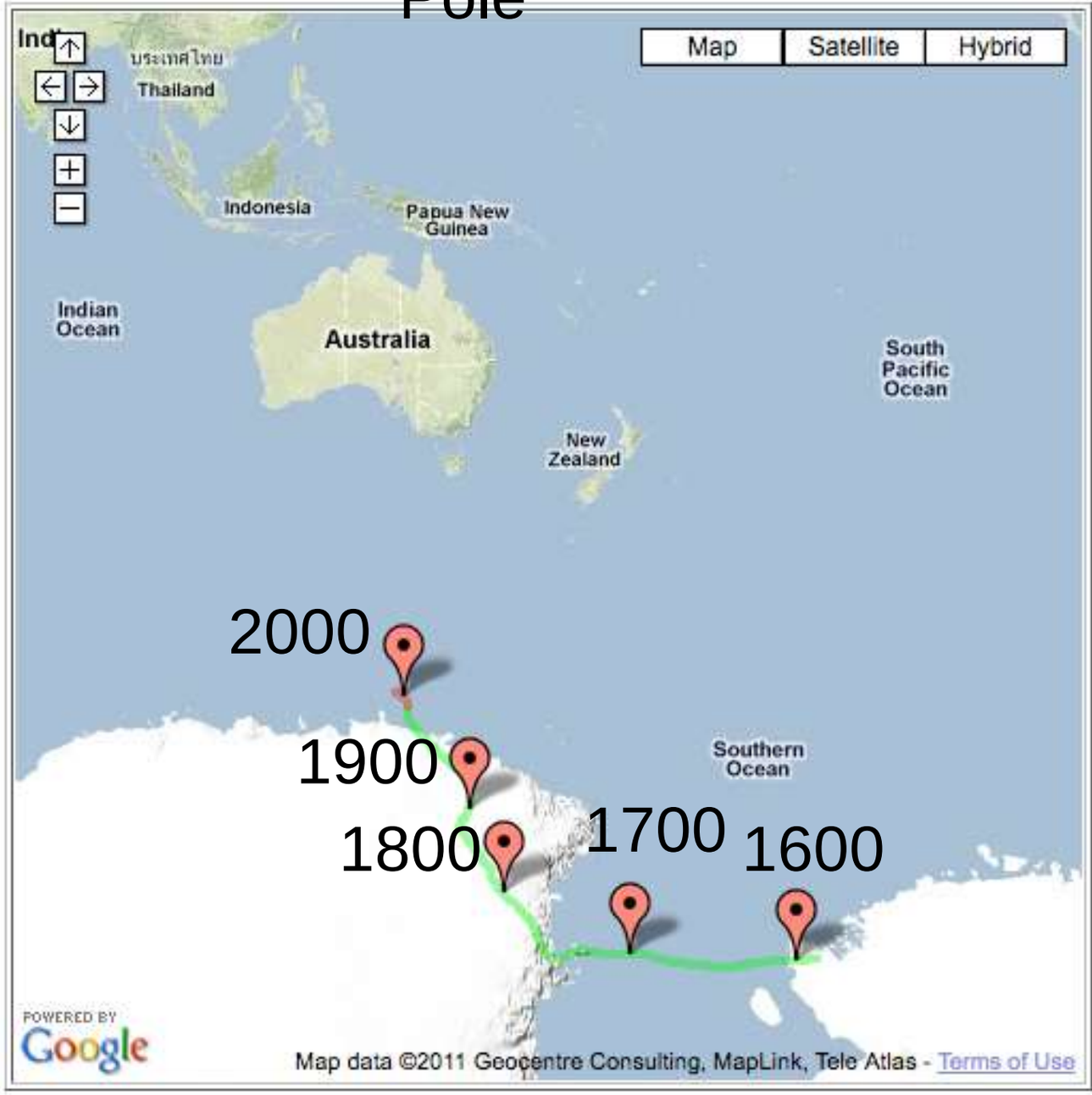
Declination changes over time

- Here in Northern California it changes by about 1° every 20 years.
- The declination shown on your topo map may be out of date.
- What about declination displayed by my GPS?
  - It probably correct as of the date of manufacture.

Magnetic Poles

North Pole

South Pole



Local Anomalies

- May be as much as 90 degrees
  - 3-4 degrees is common
- North of Kingston, Ontario; 90° of anomalous declination.
- Kingston Harbor, Ontario; 16.3° W to 15.5° E of anomalous declination over two kilometers (1.2 miles); magnetite and ilmenite deposits.
- Savoff, Ontario (50.0 N, 85.0 W). Over 60° of anomalous declination.
- Ramapo Mountains, northeastern New Jersey; iron ore; compass rendered useless in some areas.
- Near Grants, New Mexico north of the Gila Wilderness area; Malpais lava flows; compass rendered useless.

Using your GPS & compass to measure current local magnetic declination

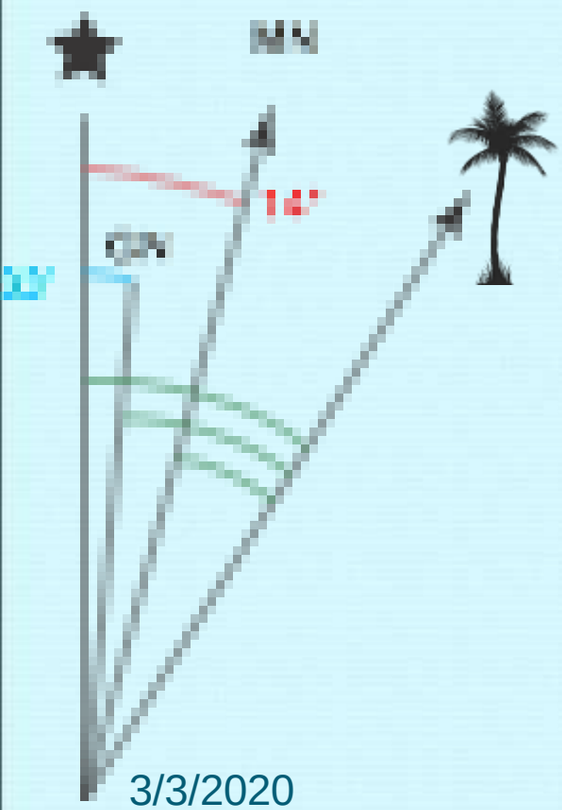
d > 300m

WPT001

GPS
GOTO WPT001
Bearing 214°
True

Compass
Bearing to
Palm
200° Magnetic

Current Local Magnetic Declination is
14° East of True North



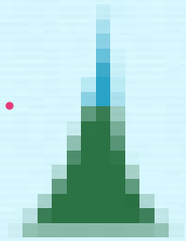
Angular Error in GPS Bearing to Waypoint

$$\tan(\alpha) = \frac{5}{\frac{d}{2}} = \frac{10}{d}$$

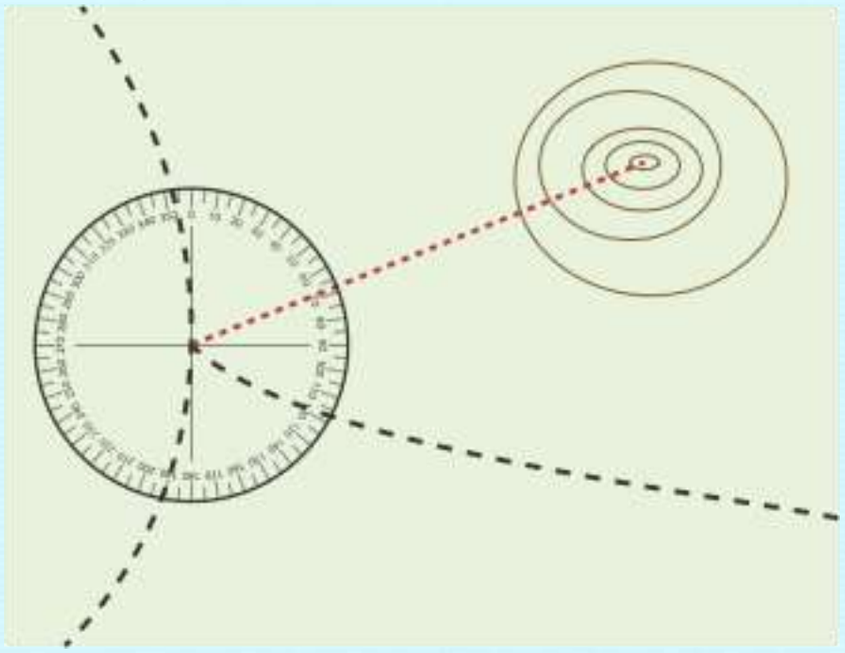
$$\alpha = \tan^{-1}\left(\frac{10}{d}\right)$$

d	α
100m	6°
200m	3°
300m	2°
400m	1.4°
500m	1.1°
600m	1.0°
700m	0.8°
800m	0.7°
900m	0.6°
1000m	0.57°

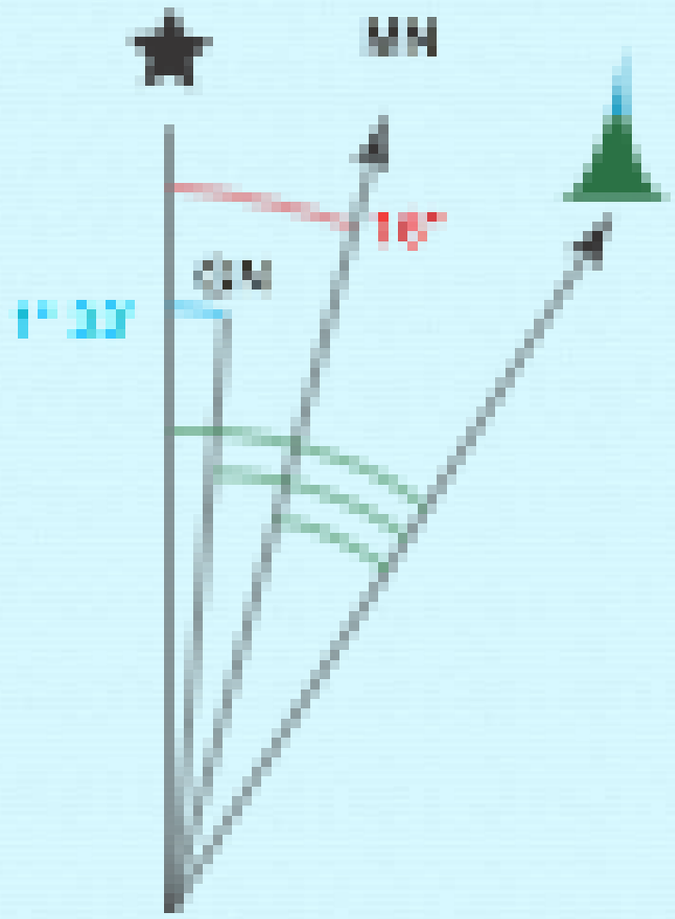
Using your map & compass to measure current local magnetic declination



Compass
Trail Jct ->
Peak
52° Mag.



From the map
Trail Jct ->
Peak
68° True



Current local magnetic declination is (68 - 52)
16° E. of True North

Check you compass & sighting technique using these methods and the declination for the area

- Find some place near your home to establish your personal compass testing location.
- Identify several features, at least 1km away, that you can sight on.
- Use a map to determine True bearings to these features. Convert these bearings to Magnetic using the calculated declination for the area.
- Check your compass and technique. Experiment with the your gear to see if it influences your compass.
- Keep notes, so you can repeat this in the future.

RIVERS AND ASSOCIATED LANDFORMS

Prof. Erande M.R.
Dept. of Geography
Shri Mulikadevi College, Nighoj

Geomorphology

- Study of surface features of the Earth, curved by river; wind or glacial action.

- Evolution and structure of various landforms related to mountains, plains, plateaus, valleys and basins are specialized field of study within geomorphology.

- **Fluvial Geomorphology**

River

- Running water is the most important agent of erosion on the continents and the stream valleys are the most common landforms.

- Rivers flowing to the oceans drain about 68 % of the Earth's land surface. The remainder of the land either is covered by ice or drains to closed basins.

- River gradually mould the land by eroding away the material in some place and depositing it in other

Presented By: Erande M.R.

- A river system consists of a main channel (trunk stream) and all of the tributaries that flow into it or joining the trunk stream.

- **A RIVER SYSTEM CAN BE DIVIDED INTO THREE SUBSYSTEMS:**

- ***collecting system*** (branches) -- consisting of a network of tributaries in the headwater region, collects and funnels water and sediment to the main stream
- ***transporting system*** (trunk) -- the main trunk stream, which functions as a channelway through which water and sediment move from the collecting area toward the ocean. (Erosion and deposition also occur in a river's transporting system)
- ***dispersing system*** (roots) -- consists of a network of distributaries at the mouth of a river (delta), where sediment and water are dispersed into an ocean, a lake, or a dry basin

Parts of River

- **tributary :** a stream flowing into or joining a larger stream
- **distributary :** numerous stream branches into which a river divides where it reaches its delta
- **upstream** : moves toward headwater (up the regional slope of erosion)
- **downstream :** moves toward mouth of river (delta)
- **Delta :** a large, roughly triangular body of sediment deposited at the mouth of a river
- **Meander :** a broad, looping bend in a river
- **Braided :** river is divided into multiple channels by alluvial islands. Braided rivers tend to have steeper gradients

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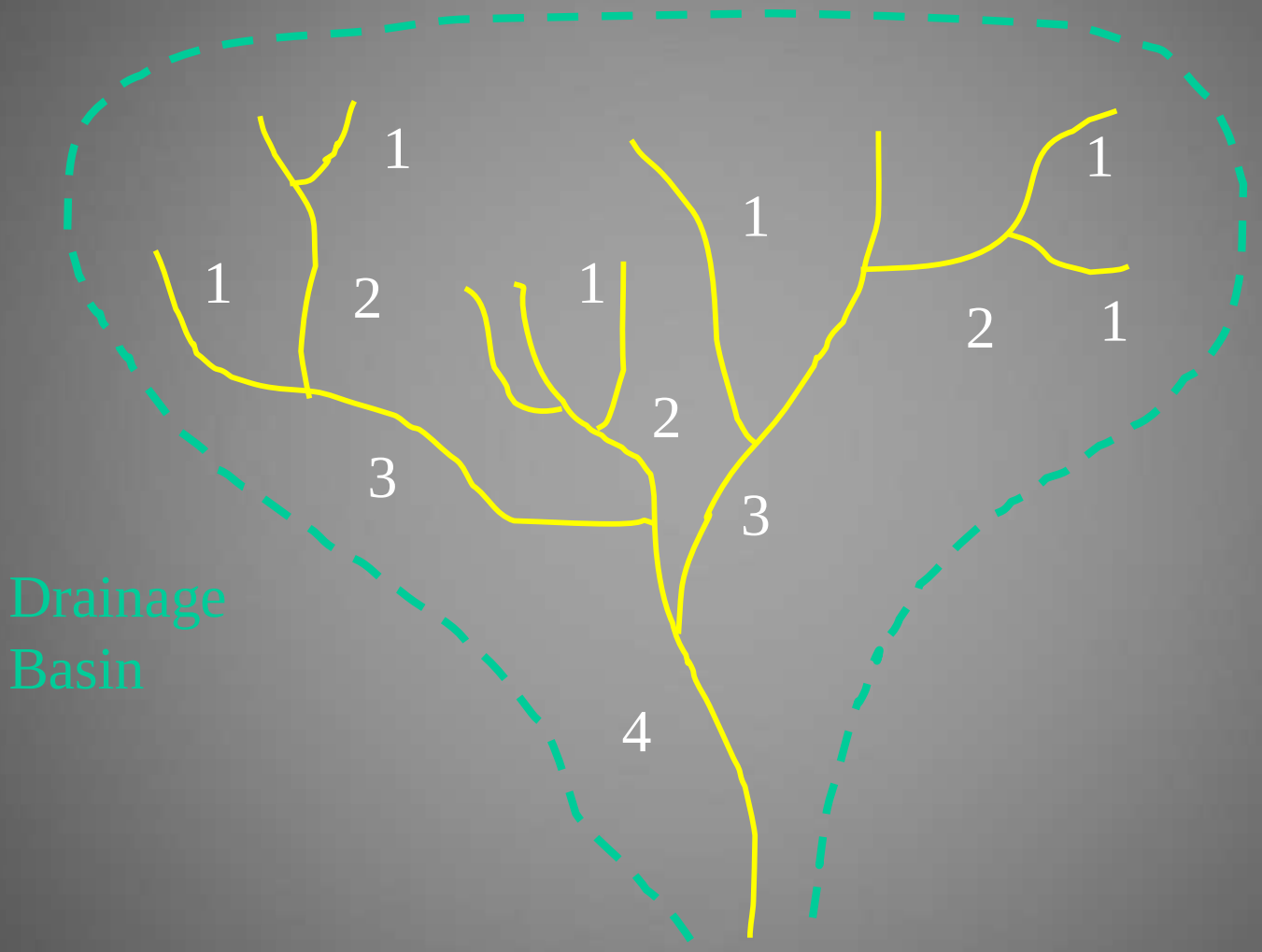
Stream Order



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FLUVIAL LANDFORMS

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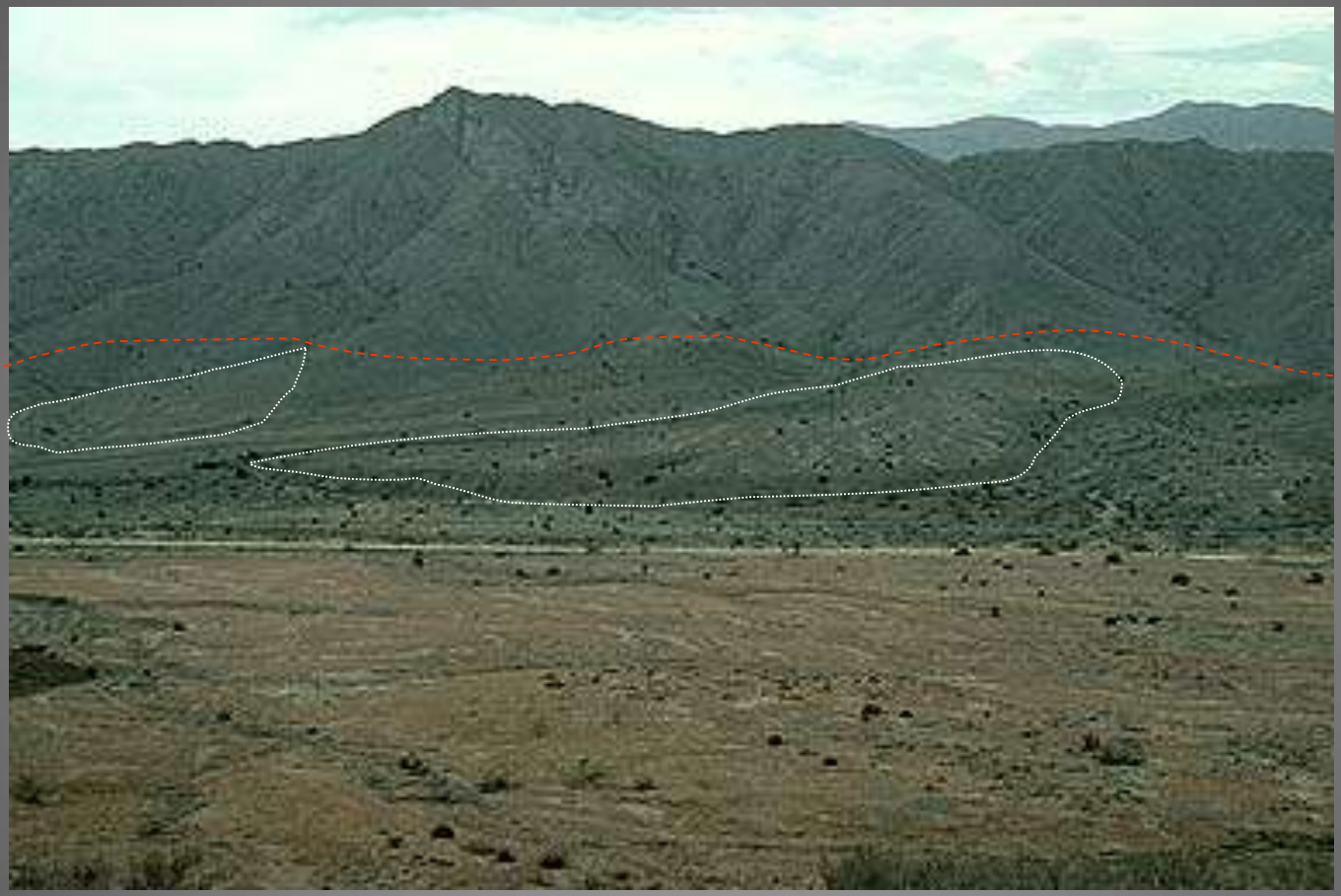

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- *Alluvial fans are fan-shaped deposits of water-transported material (alluvium).*
- *They typically form at the base of topographic features where there is a marked break in slope.*
- *Consequently, alluvial fans tend to be coarse-grained, especially at their mouths. At their edges, however, they can be relatively fine-grained.*

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Braided Channel

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- Braided Rivers exhibit numerous channels that split off and rejoin each other to give a braided appearance. They typically carry coarse-grained sediment down a steep gradient.

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Meandering Pattern

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- In contrast to braided rivers, meandering rivers typically contain one channel that winds its way across the floodplain. As it flows, it deposits sediment on banks that lie on the insides of curves (point bar deposits), and erode the banks on the outside of curves.

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- ***Deltas form wherever rivers encounter standing bodies of water such as lakes or oceans.***

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- The Ganges and Brahmaputra Rivers combined have formed one of the largest deltas in the world, comprising approximately 105 640 km^2.
- The Ganges River originates near the Tibet/India border, and then flows southeast across India to combine with the Brahmaputra in the country of Bangladesh.
- The Brahmaputra River has its source in Tibet along the northern slope of the Himalayas, and flows across Assam into Bangladesh. The drainage basin, approximately 1.6 million km^2 in area, is geologically young, with large volumes of unconsolidated sediment available for transport

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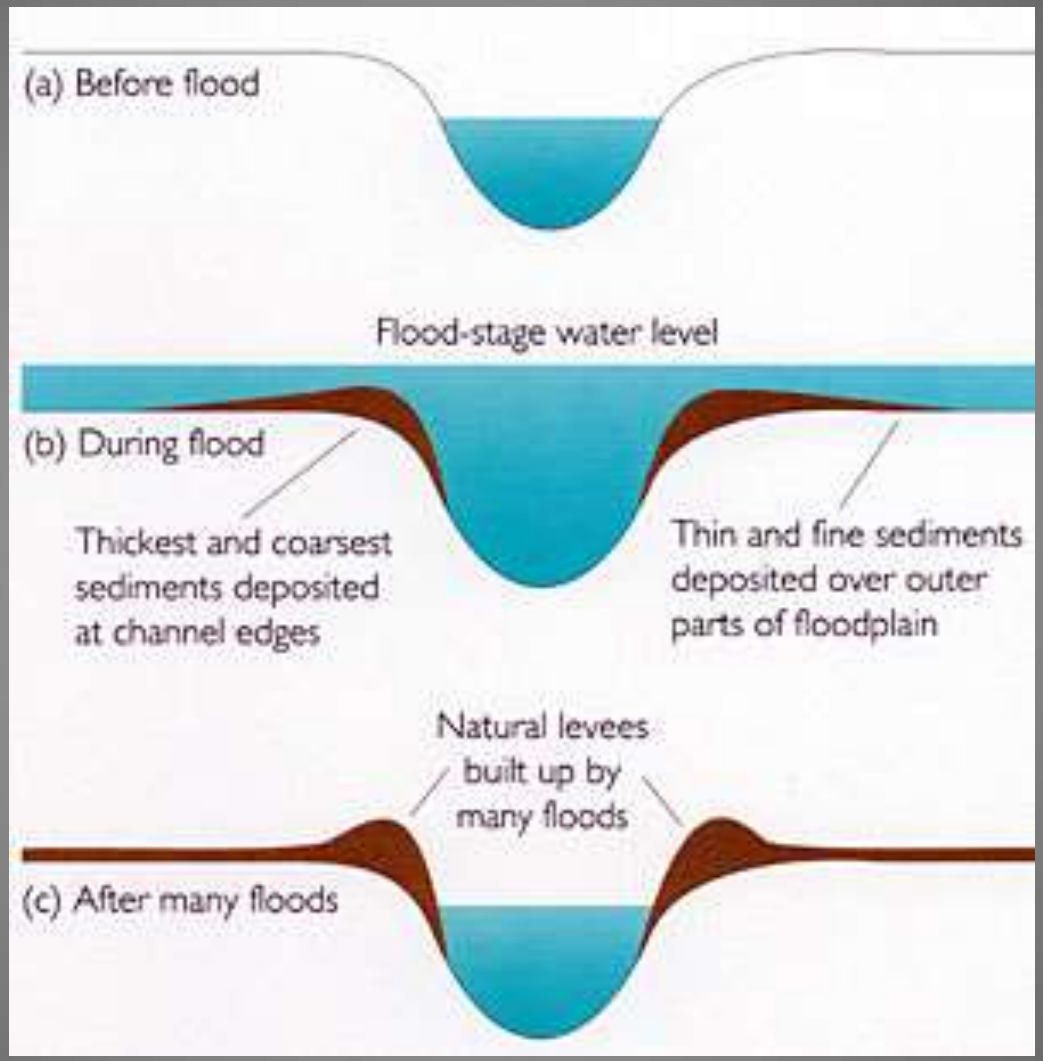
Levees



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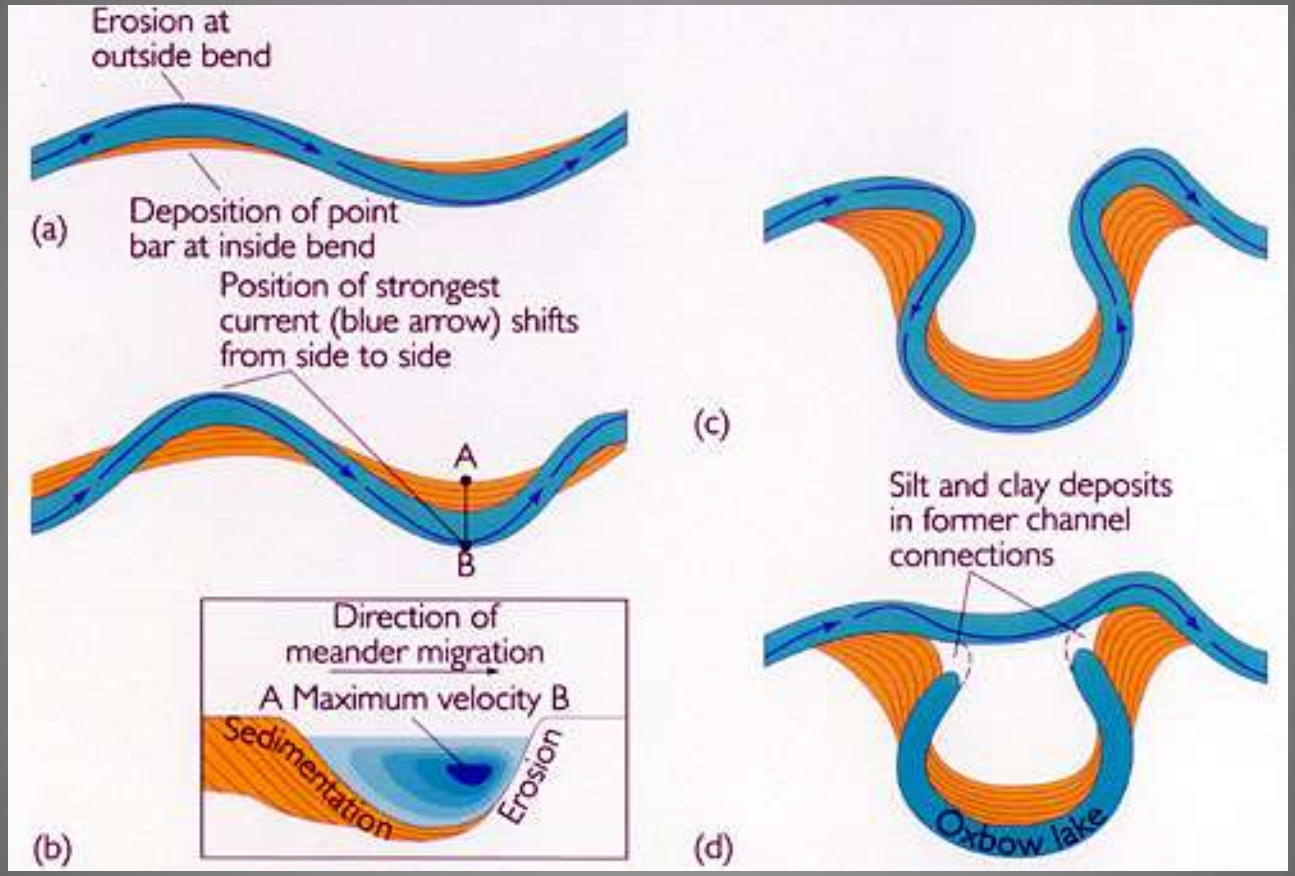
Oxbow lakes



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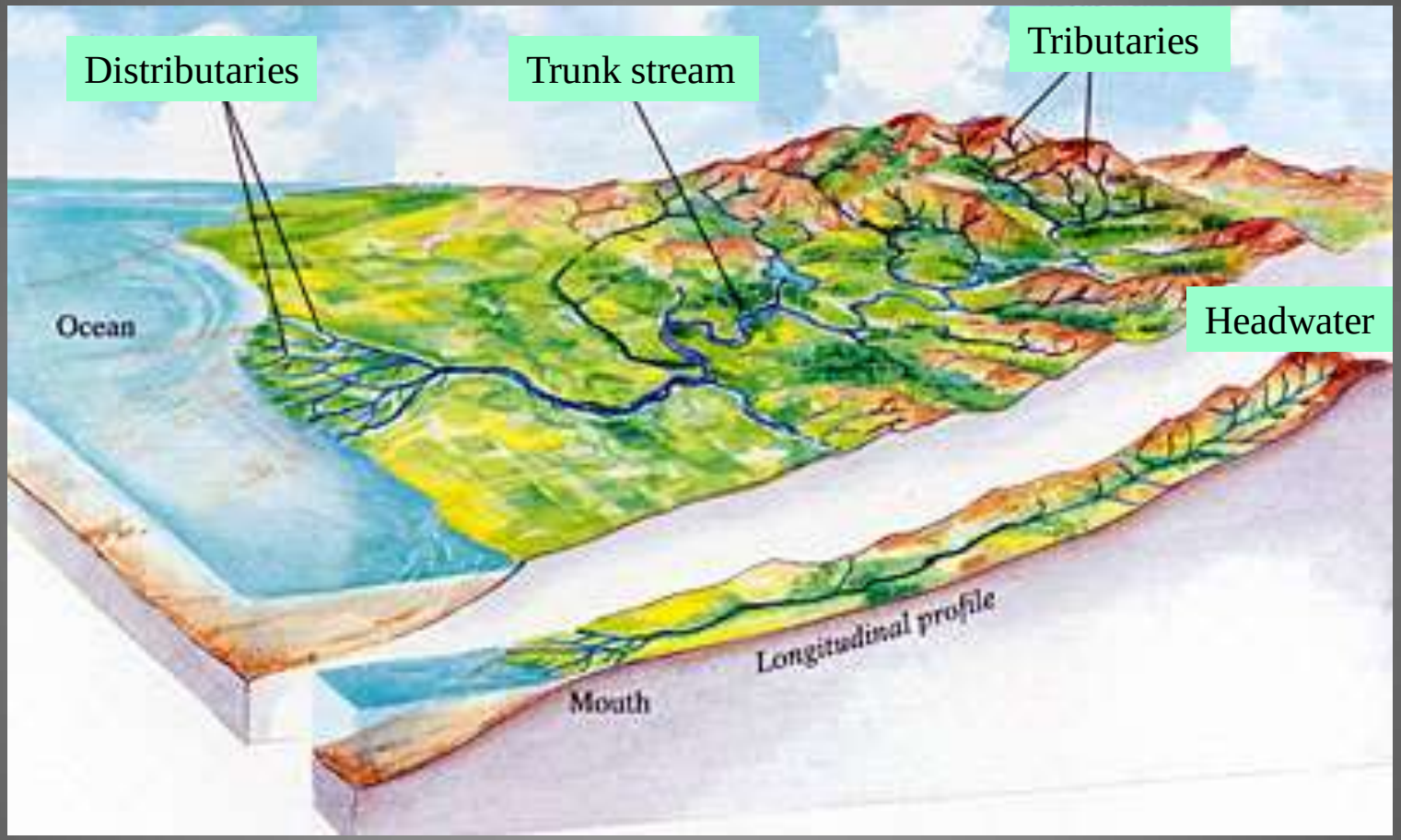
River system



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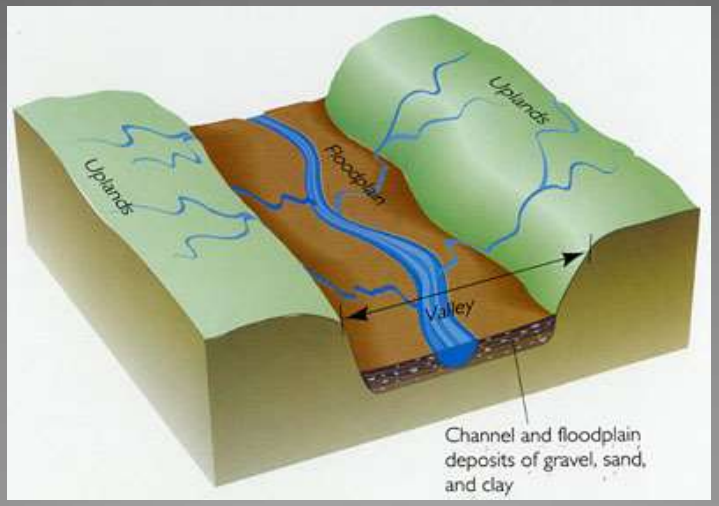

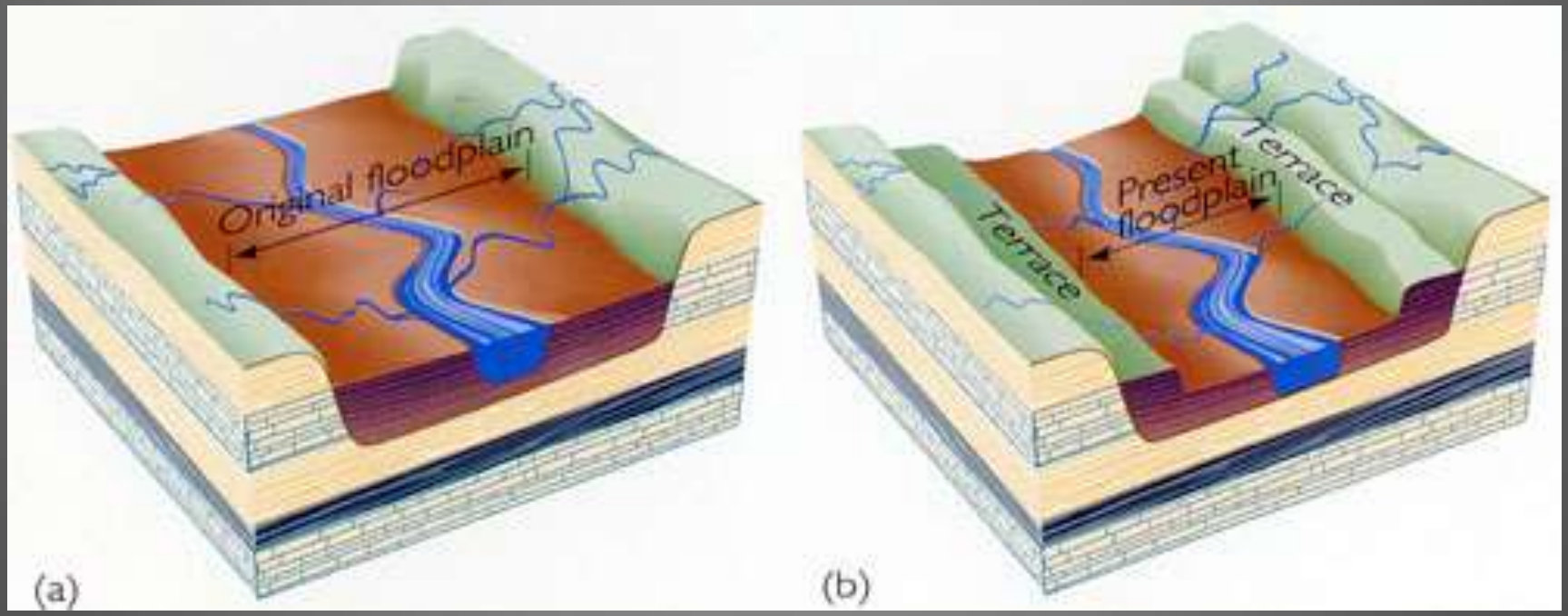

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Hazard and Disaster Classification

By
M.R. Erande
Dept. of Geography
Shri Mulikadevi College, Nighoj

Major Categories

- Natural Hazards
- Anthropogenic Non-Intentional
- Anthropogenic Intentional

Earth Hazardous to your health?

- 516 active volcanoes, eruption every 15 days (average)
- 2,000 tremors daily
- 2 significant earthquakes daily, severe damage 15-20 times annually
- 1,800 thunderstorms at any given time

Still hazardous?

- Lightning strikes 100 times per second
- Late summer, an average of 5 hurricanes developing
- 4 tornadoes per day or 600-1000 annually
- 11 blizzards annually in the United States

Categories of Natural Hazards

- Atmospheric (Meteorological)
- Geological (Earth)
- Hydrological (Water)
- Extraterrestrial
- Biological

Atmospheric-Sourced Processes

- Tropical cyclones
- Thunderstorms
- Tornadoes
- Lightning
- Hailstorms
- Windstorms
- Ice storms
- Snowstorms
- Blizzards
- Cold waves
- Heat waves
- Avalanches
- Fog
- Frost

Geological-Sourced Processes

- Earthquakes
- Volcanoes
- Tsunami
- Landslides
- Subsidence
- Mudflows
- Sinkholes

Hydrological-Sourced Processes

- Floods
- Droughts
- Wildfires

Extraterrestrial Processes

- Meteorites
- Asteroids

Biological Processes

- Diseases
- Epidemics
- Pandemics
- Overpopulation
- Famine

Anthropogenic Non-Intentional

- Technological
- Hazardous Materials
- Environmental
- Industrial
- Mining
- Nuclear
- Transportation
- Structural

Technological

- Acts of People
- Technological systems that fail because of complexities and human fallibility (accidents)

Hazardous Materials

- Can classify in different categories

Environmental

- Can classify in different categories

Industrial

- Factories
- Refineries

Mining

- Coal
- Safety Standards

Nuclear

- Power plants
- Industrial use
- Medical use

Transportation

- Aviation
- Highways
- Railroads
- Maritime

Structural

- Fires
- Collapse

Anthropogenic Intentional Hazards

- Mass Shootings
- Civil Disobedience
- Terrorism
- Weapons of Mass Destruction

Mass Shootings

- School shootings
- Workplace violence
- Hate crimes

Civil Disobedience

- Labor riots
- Race riots
- Political riots

Terrorism

- State/State Sponsored
- International Non-state
- Domestic

Weapons of Mass Destruction

- Explosives
- Chemical
- Biological
- Nuclear/Radiological

DISASTER MANAGEMENT:

BY

M.R. Erande,
Dept. of Geography
Shri Mulikadevi College, Nighoj

MAJOR DISASTERS IN INDIA : 1990 - 2005

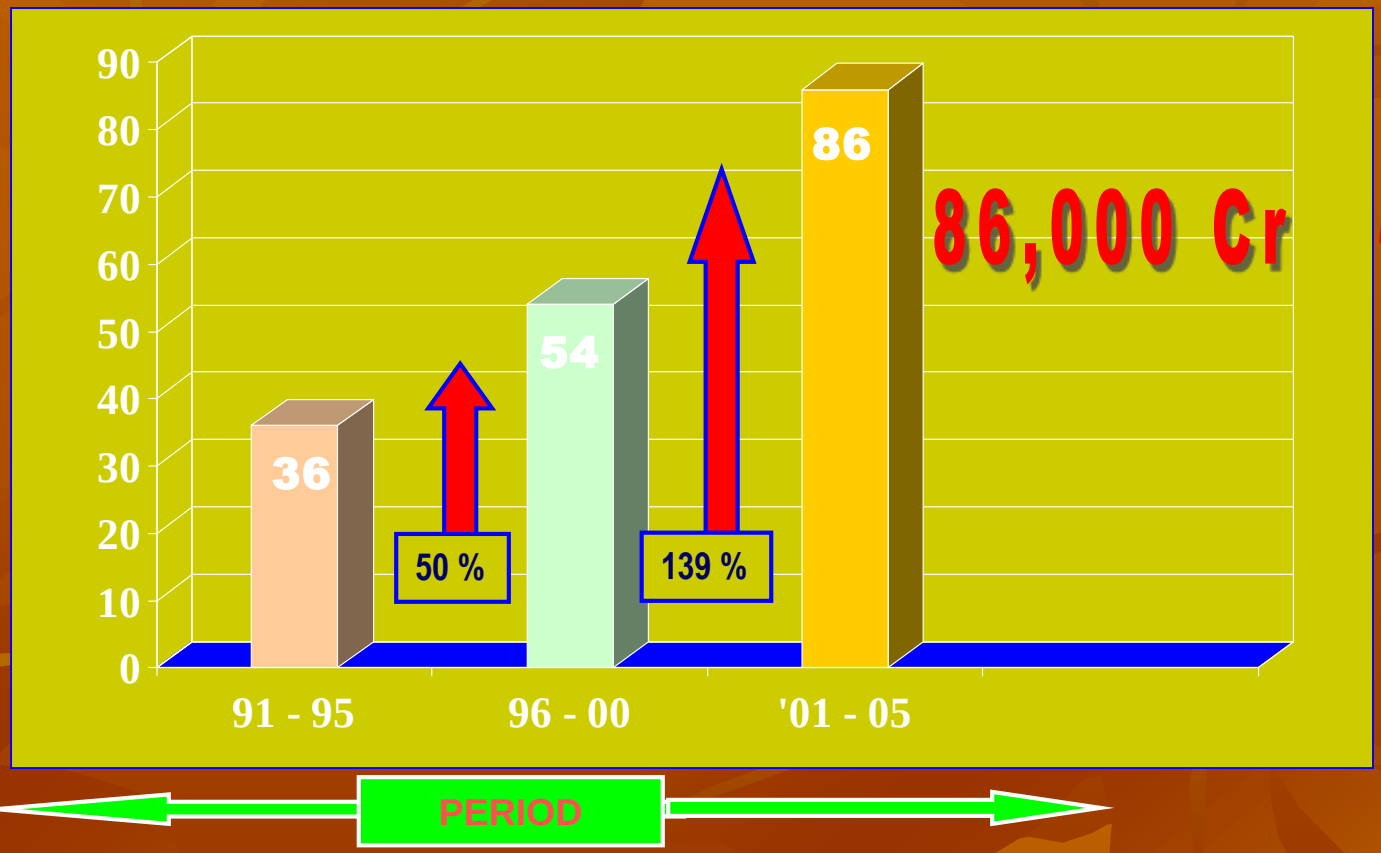
YEAR	PLACES &	DISASTER	LOSS OF LIVES (APPROX)	LOSS OF PROPERTY (Rs Crore) (APPROX)
1991	Uttarkashi	Earthquake	2000	2000
1993	Latur	Earthquake	9500	6000
1997	Jabalpur	Earthquake	200	5000
1999	Chamoli	Earthquake	2000	2000
1999	Orissa	S Cyclone	9887	10000
2001	Bhuj	Earthquake	14000	13400
2004	SE India	Tsunami	15000	10000
2004	Assam & Bihar	Floods	700	5000
2005	J&K	Avalanche	350	100
2005	Mah, Guj, HP, Karnataka, T'Nadu	Floods	1569	10300
2005	J&K	Earthquakes	1336	1000
	Total Losses of Major Disasters only		56542	64800

1. If Average Annual Lives Lost are Added, Figure Will go to More than → 121,500
2. Adding Average Annual Losses, the Figure Will be More than → 156,000 Cr

INDIA

ECONOMIC LOSSES DUE TO DISASTERS

Losses in Thousand Crores



Annual- Impact on People

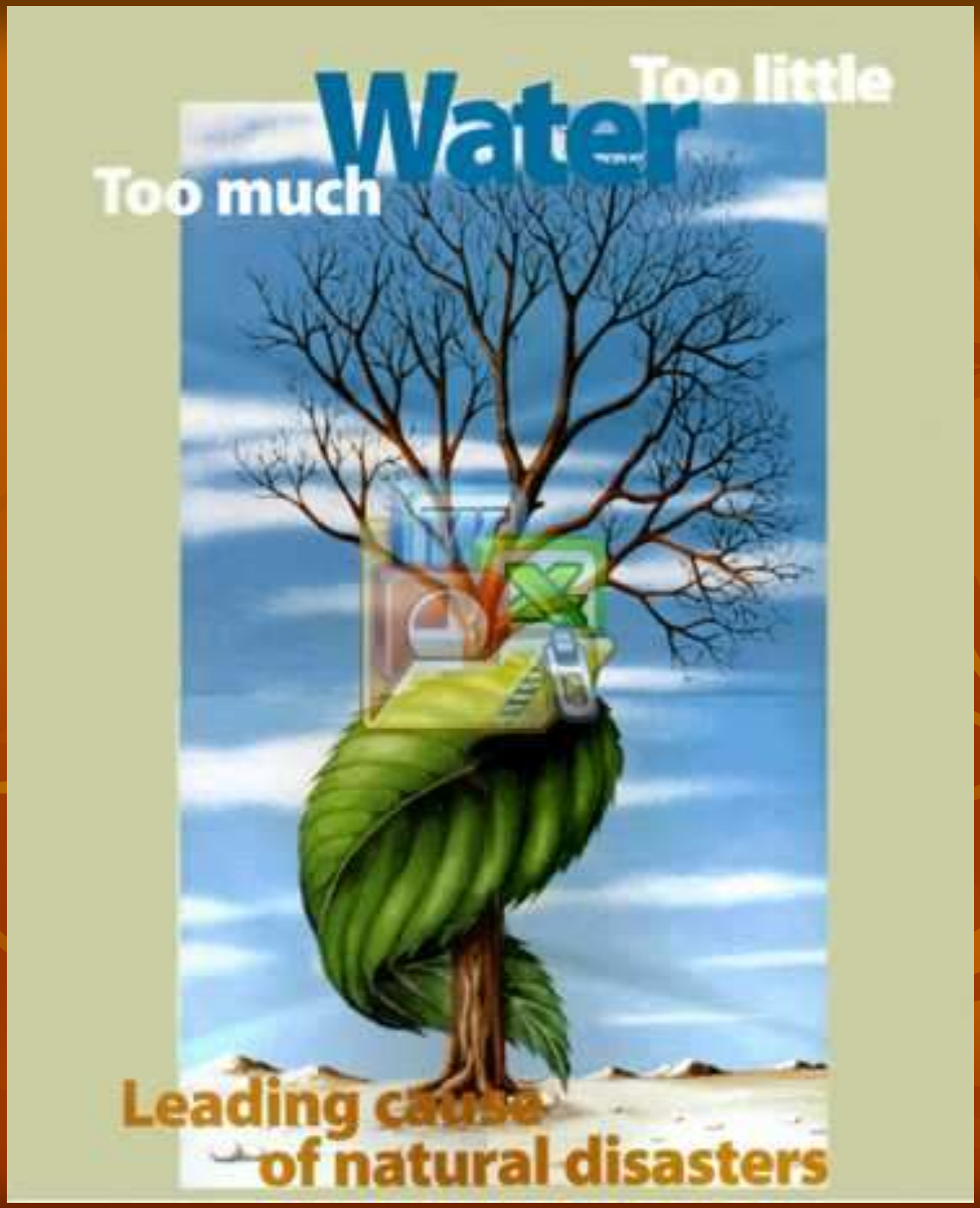
1. Losses in lives - 4334.
2. People affected - 30 Million.
3. Houses lost - 2.34 Million.

Annual- Financial Losses

Percentage of Central Revenue (for relief) – 12%.

FACTORS RESPONSIBLE FOR INCREASING NUMBER OF DISASTERS

- **Population Growth and Urban Development**
- **Development Practices**
- **Climatic changes**
- **Effect of Environmental degradation**

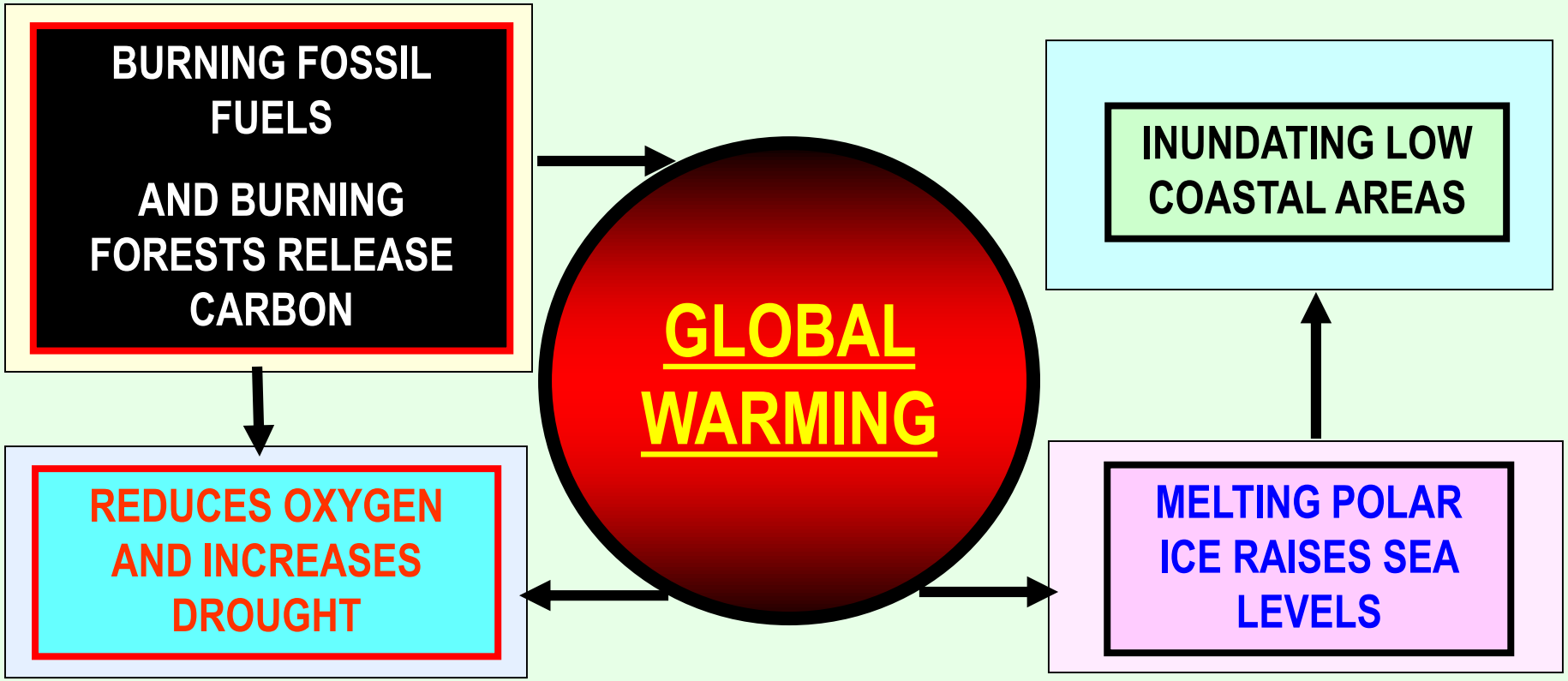

Too little
Water
Too much
Leading cause
of natural disasters

POLAR ICE CAPS ARE MELTING FASTER THAN EVER…

MORE AND MORE LAND IS BEING DEVASTATED BY DROUGHT…

RISING WATERS ARE DROWNING LOW-LYING COMMUNITIES…

VICIOUS CYCLE



NOW IT IS VERY MUCH EVIDENT THAT CLIMATE DISRUPTIONS FEED OFF ONE ANOTHER IN ACCELERATING SPIRALS OF DESTRUCTION.

MUMBAI FLOODS

1. Plans

Existed on Paper But, Enforcement Lacking.

2. Police

Most Crucial Responder - NOT Formally Part of Response Plan.

3. Timely Warning

Technological Shortfall - Many Lives Could have Been Saved.

NATURAL DISASTERS – LESSONS LEARNT

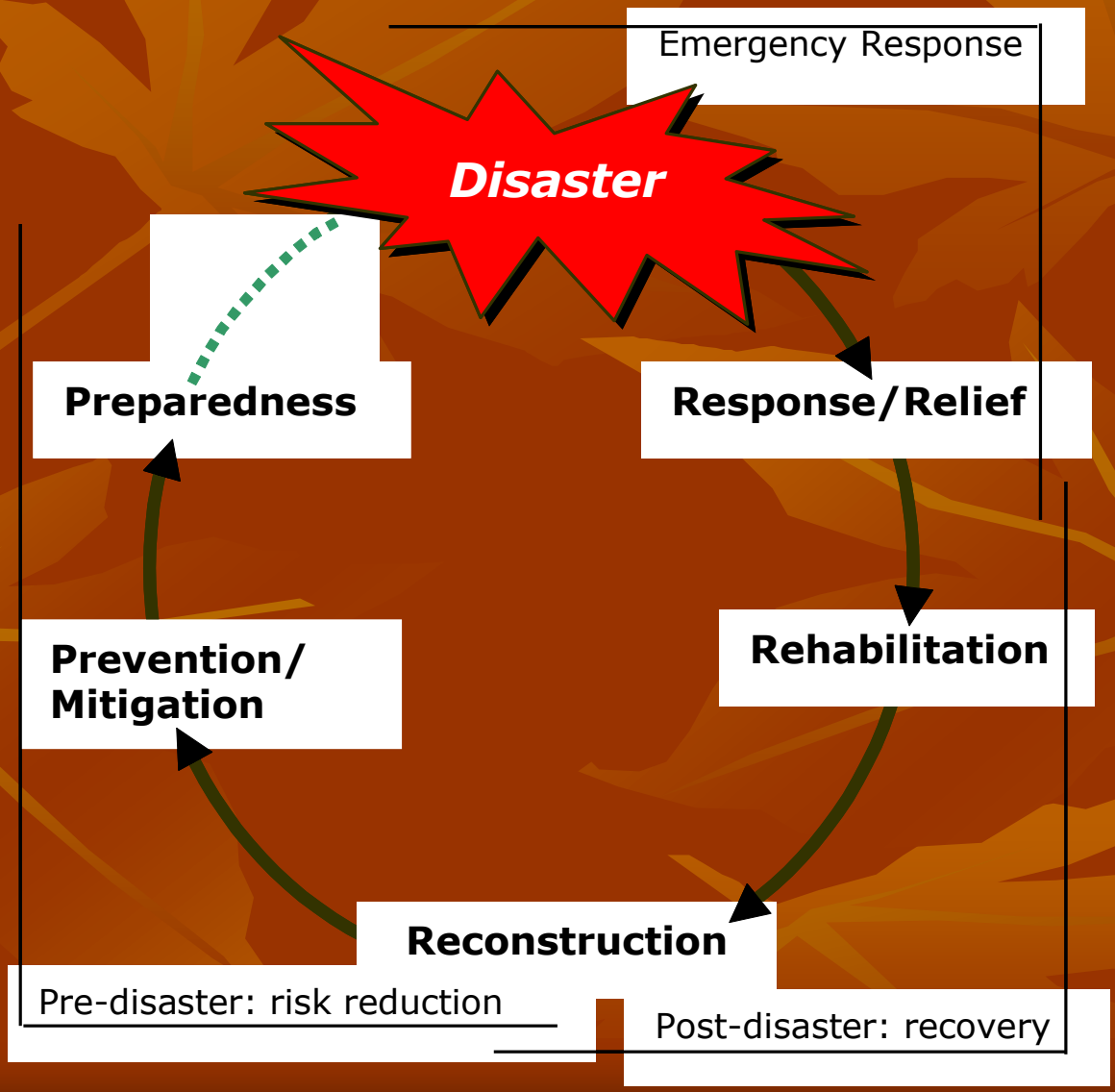
1. Mitigation Systems Require Manifold Improvement & should be "Technology Driven".
2. Weakness in "Early Warning Systems" and Dissemination of Information to Far Flung Areas.
3. Decision to Provide Aid :-
   (a) Slow because of Procedures.
   (b) Request from States not backed by Proper Assessment.
4. States Organizations – Not Geared to Guide & Receive Aid.
5. Disaster Response Resources at State Level – Very Inadequate.

NATURAL DISASTERS – LESSONS LEARNT

6. Non Availability of Specialist Equipment,
   (Incl Mobile Field Hospitals).
7. Assistance from NGOs NOT Coordinated & Optimised.
8. People - Principal Actors -- Focused Public Awareness Campaign a Must.
9. Post Disaster Relief & Reconstruction - Lot of GAPS.

10. Positive Lesson -- Role of the Armed Forces

DISASTER MANAGEMENT CYCLE



WHAT IS A DISASTER?

DISASTER is an event which is –

-generally unpredictable,

-happens instantly or without giving enough time to react

-affecting a large number of people,

-disrupting normal life and leading to a large scale devastation in terms of loss of life and property

-always finding the administration and affected people struggling to respond in the desired manner and

-leaving deep socio-psychological, political and economic after effects which persist for a long time to come.

CLASSIFICATION OF DISASTERS

- Natural, Man-made & Human-induced

- ✓ Disasters occur in varied forms
  - Some are predictable in advance
  - Some are annual or seasonal
  - Some are sudden and unpredictable
- ✓ Factors leading to a Disaster
  - Meteorological, Geological, Ecological or Environmental, Technological Etc.

NATURAL DISASTERS

- Floods
- Earthquakes
- Cyclones
- Droughts
- Landslides, Pest Attacks, Forest Fires, Avalanches etc

TIME DURATION OF NATURAL DISASTERS

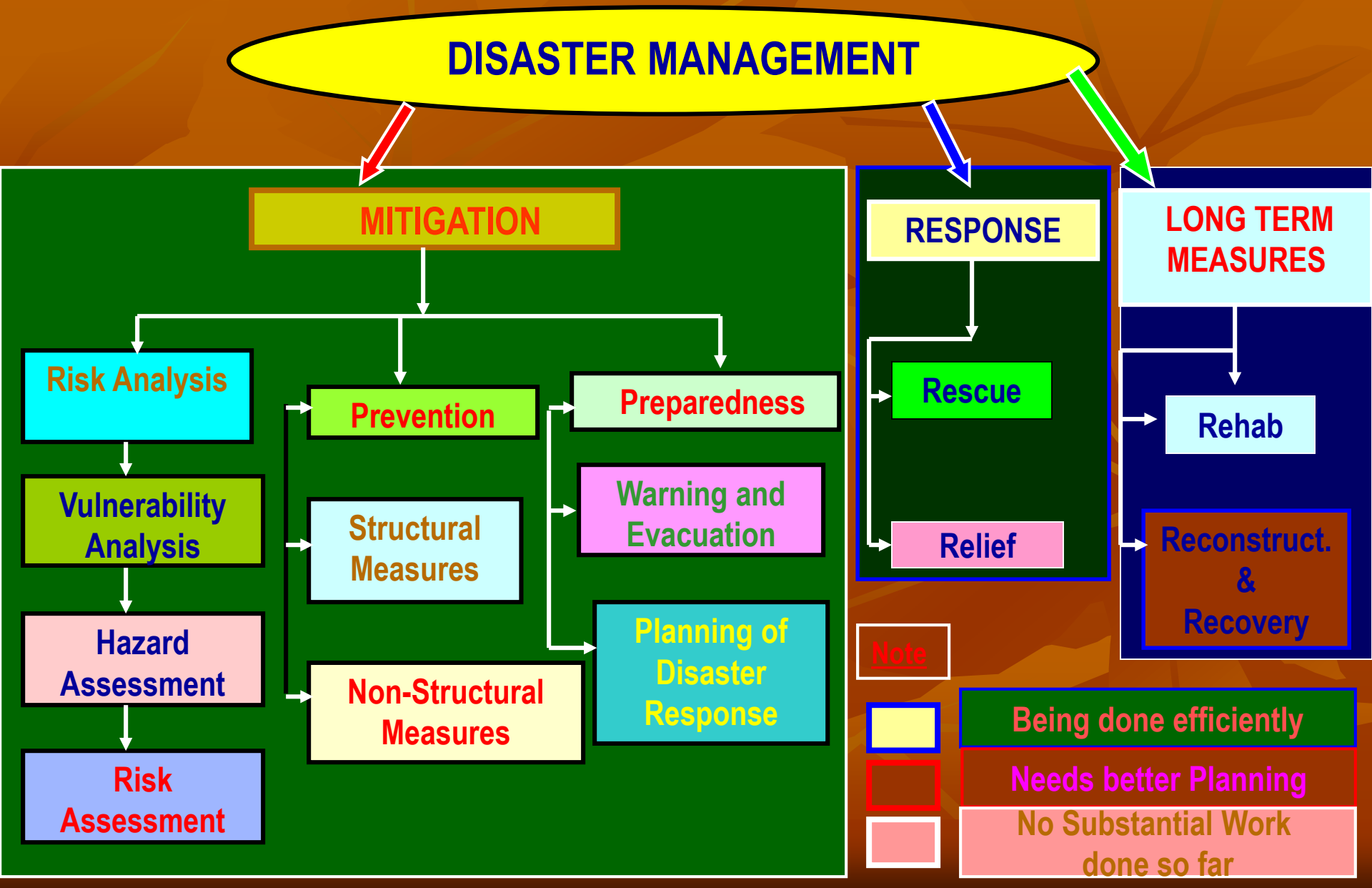
Earthquakes -> Seconds/minutes

Cyclones -> Days

Floods -> Days

Droughts -> Months

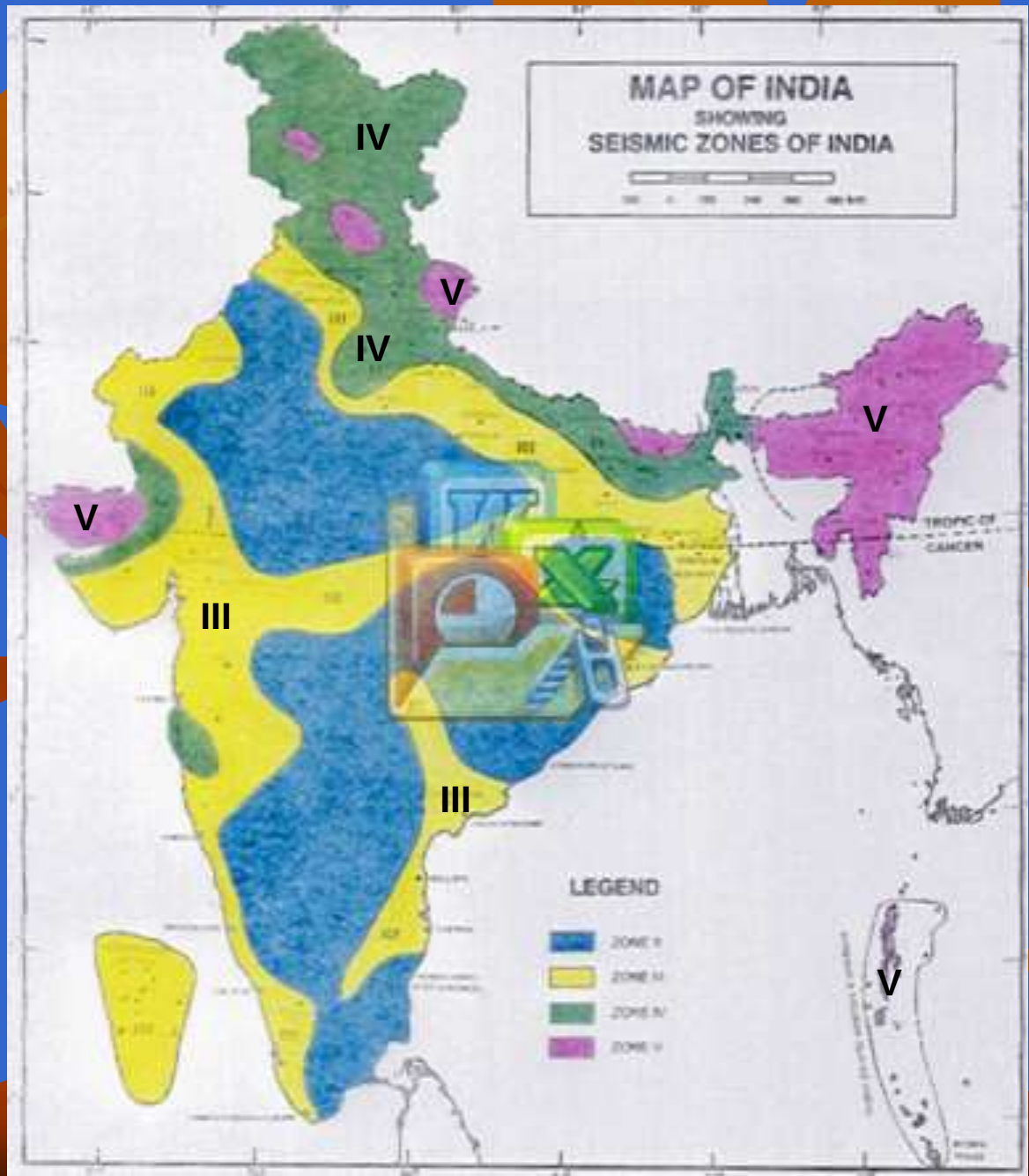
DISASTER MANAGEMENT CONTINUUM



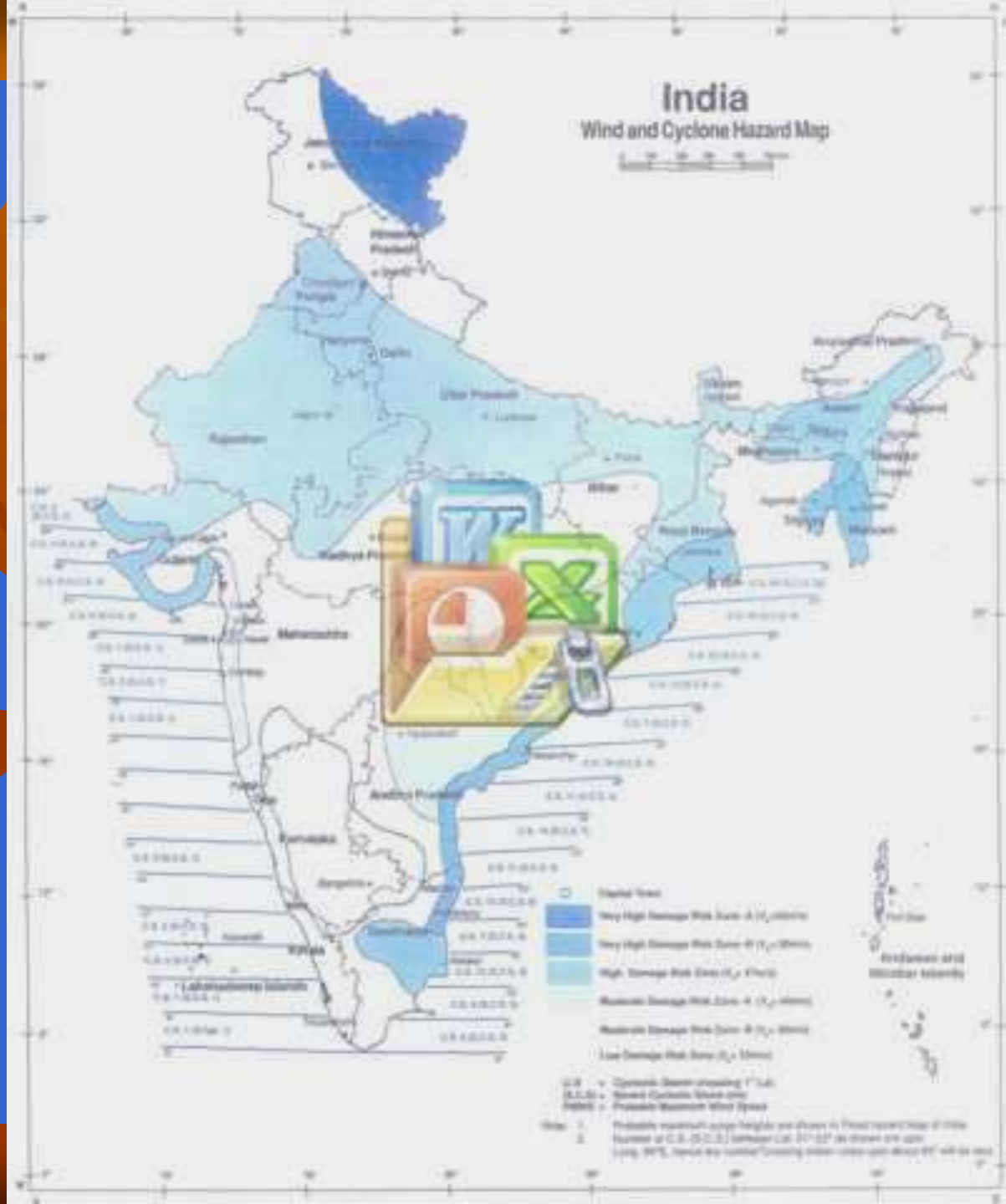
EARTHQUAKE HAZARD ZONES 2002

Zone V MM IX or more
“ IV MM VIII
“ III MM VII

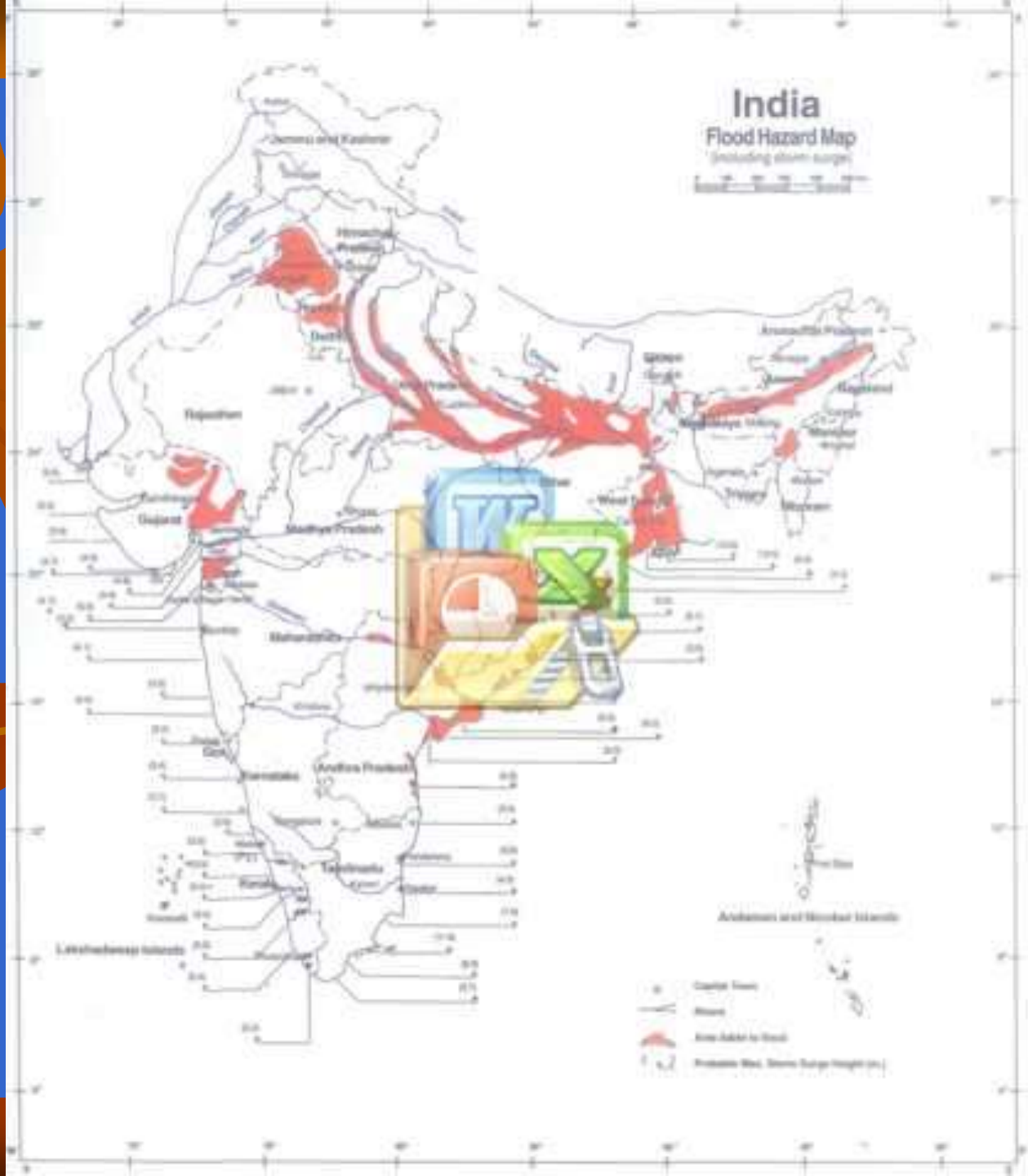
Zone II MM VI
“ I MM V or less
together now make
Zone II MM VI or less
Area under the zones
V 12%
IV 18%
III ~27%
Total damageable
~ 57%



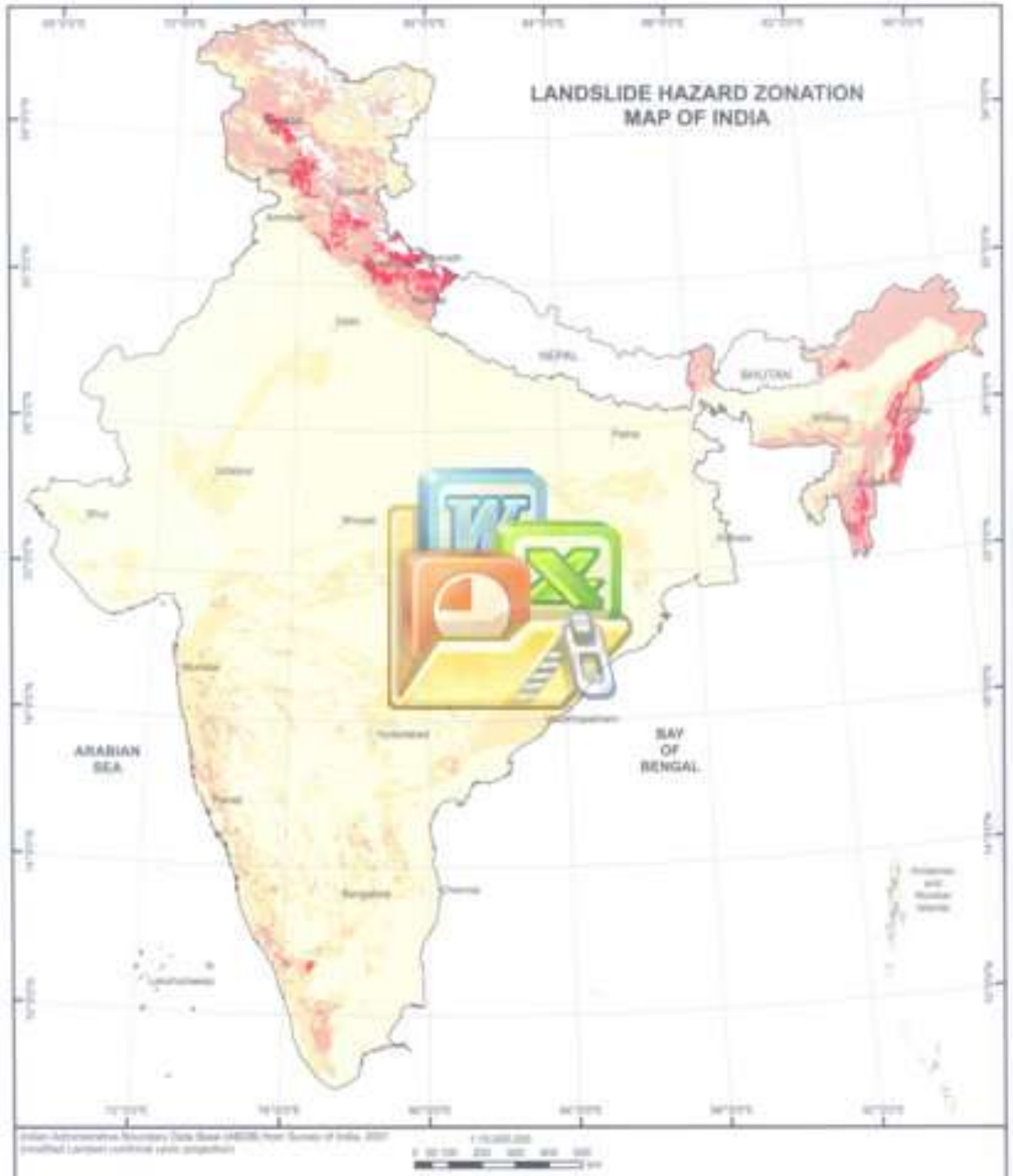
WIND & CYCLONE HAZARD ZONES IN INDIA



FLOOD HAZARD PRONE AREAS OF INDIA



LANDSLIDES ZONATION MAP OF INDIA



- Severe Risk Area
- High Risk Area
- Moderate Risk Area
- Unlikely Occurrence

VULNERABILITY OF STATES

Types of Disaster *	Name & No of States/UTs	
5	Gujarat	1
4	Maharashtra, AP, Orissa & A&N Islands	4
3	NE States, W Bengal, Bihar, TN- - -	10
2	Delhi, UP - - - -	17
1	*Rajasthan,- - -	3

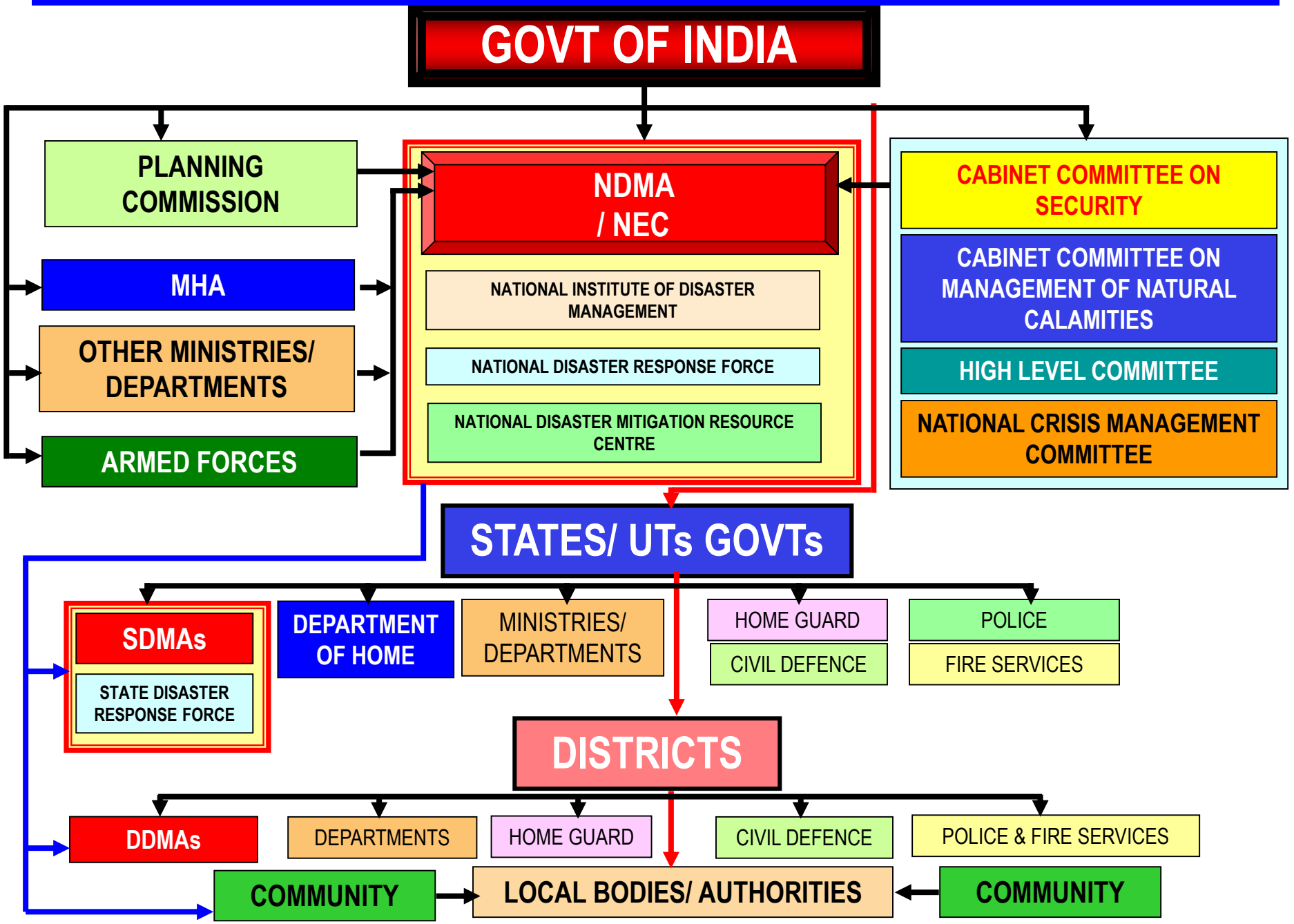
*Even though affected only by Drought but suffers heavy Financial Losses averaging Rs. 3 to 8 Thousand Crores, Annually.

*Types: Earthquake, Cyclone, Tsunami, Flood, Drought & Landslide.

DISASTER MANAGEMENT ACT, 2005

"In order to Coordinate Central Govt efforts in Preparedness, Prevention, Response, Mitigation, Relief and Rehabilitation and for adoption of a Holistic Pro-active Approach to Disaster Management, a NATIONAL DISASTER MANAGEMENT AUTHORITY has come into being by an Act of Parliament in December 2005 under the Chairmanship of Prime Minister as the NODAL AGENCY for Disaster Management in the Country."

NATIONAL DISASTER MANAGEMENT STRUCTURE



STRATEGY
FOR
DISASTER RISK REDUCTION

STRATEGIES FOR DISASTER MANAGEMENT

1. Change of Focus from Relief Centric to Holistic Approach.
2. Mainstreaming Disaster Management into all National Developmental Programmes.
3. Empowerment of the Community to face the Disaster.
4. Emphasis on Training, Development of Human Capital and Capacity Building.
5. Key Role of Educational and Professional Institutions for Mass Education and Awareness.
6. Upgradation of the Key Responders.

DISASTER MANAGEMENT:

BY

M.R. Erande,
Dept. of Geography
Shri Mulikadevi College, Nighoj

HAZARD

A dangerous condition or events that threaten or have the potential for causing injury to life or damage to property or the environment. Hazards are basically grouped in two broad headings:

- *Natural Hazards* (hazards with meteorological, geological or biological origin)
- *Unnatural Hazards* (hazards with human-caused or technological origin)

Natural phenomena are extreme *climatological*, *hydrological*, or *geological*, processes. A massive earthquake in an unpopulated area, is a natural phenomenon, *not a hazard*. But when these natural phenomena interact with the man made habitat, they may cause wide spread damage. Then, they become hazard

VULNERABILITY

Vulnerability is defined as *"The extent to which a community, structure, service, or geographic area is likely to be damaged or disrupted by the impact of particular hazard, on account of* ***their nature****,* ***construction*** *and* ***proximity to hazardous terrain*** *or a* ***disaster prone area****.“*

- *Physical vulnerability* – weak buildings, bridges, service lines, lifeline structures, production units etc.
- *Social & Economic vulnerability*

Human losses in disasters in developing countries are seen to be higher when compared to developed countries.

RISK

Risk is a measure of the expected losses (deaths, injuries, property, economic activity etc) due to a *hazard* of a particular *magnitude or Intensity* occurring in a given area over a specific time period.

- *Exposure:* the value and importance of the various types of structures and lifeline systems (such as water-supply, communication network, transportation network etc in the community serving the population)

LESSONS LEARNT – HURRICANE KATRINA

"And any time you break that cycle of Preparing, Responding, Recovering and Mitigating, you are doomed to failure. And the policies and decision that were implemented by DHS put FEMA on a path to failure."

-Michael Brown,Director,FEMA

General

1. The Foremost Lesson - all Facets of Disaster Cycle should be under one Agency and not split among Multi-facet Authorities.

Mitigation & Preparedness

2. State's Sovereignty be maintained in all Phases of Disaster Cycle.
3. Creating Culture of Preparedness at Community level.
4. Integrated Approach (of the Civil and Military efforts) for Preparedness. Coopt Armed Forces in Disaster Response Plan.
5. Removal of Red Tapism and Bureaucratic Approach. US National Response Plan is elaborate but **Failed to Deliver**. Need to **Rewrite Rationale Response Plan** to include, conduct of mock drills periodically, state-of-the-art system in supply chain management of relief supplies and inventory tracking.

6. Training and Equipping of Central Response Force duly backed by trained teams from Armed Forces

7. Safe Houses . Identify shelters, for accommodating evacuees, both in Govt and Private Sector, during Emergencies.

8. Establishment of a Homeland Security University. On the lines of National Defence University, for General Awareness, Training and Research.

9. Use of Experts to find solutions to disaster related issues.

Communications

10. Failure within the DHS and in Communicating Relevant Information to Public, for Early Warning, resulting in all **available Federal Assets not being utilised.** Need to develop a more **Comprehensive Emergency Communication System,** to ensure **Survivability, Operability, Inter-Operability and Redundancy.**

Response

11. **Disaster Response Group** at Central level to resolve disagreements on **Employment of Resources**. This Group should also act as **Single Window Assistance Access** for public.
12. Security of Assets by employing Local Law Enforcing Force for Law and Order.

13. **Coordination,** between:

(a) Search & Rescue and Medical Teams.

(b) State and Central Response Teams

(c) Local (Distt), State and Central Response Teams, to have inter-operable Communication Network.

(d) At State level, Volunteer Coordinators in` **State Emergency Operation Centre,** for coordinating Volunteer Efforts, like Debris Clearance, etc.

(e) **Integrated Command** at field level – local Response Units (**National Guards**) and Active Duty Forces (**ex Armed Forces**) to work in tandem. **Mobile Command Field Centre** near disaster site (not 80 km away in Baton Rouge like during Katrina).

14. **Need for National Emergency Operation Centre at DHS.** DHS to have a National Emergency Operations Centre, in addition to **White House Situation Room**, regardless of whether President & the Secretary DHS are in same place, to maintain flow of information from one agency.

15. **Integrated Response.** Civil and military assets to be combined and employed as one resource and NOT in a graduated manner.

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The Work of Rivers

Prof. Erande M.R.

Dept. of Geography

Shri Mulikadevi College, Nighoj

The Work of Rivers

The erosional work of streams/rivers carves and shapes the landscape through which they flow.

3 functions of rivers

a. Erosion

b. Transportation

c. Deposition

Presented By: Erande M.R.

The Work of Rivers

A. Erosion

•A river may erode in 4 ways

1.Abrasion/corrasion

Load carried by a river will grind against its bed and sides.

This process slowly wears the bed and sides away.

The Work of Rivers

A. Erosion

2. **Attrition**

When thrown against the sides and bed of rivers, the load gets broken into smaller pieces.

The Work of Rivers

A. Erosion

3. **Hydraulic action**

The work of turbulence in the water.

Running water causes friction in the joints of rocks in a stream channel

Joints may be enlarged

Loosened fragments of rocks get swept away.

The Work of Rivers

A. Erosion

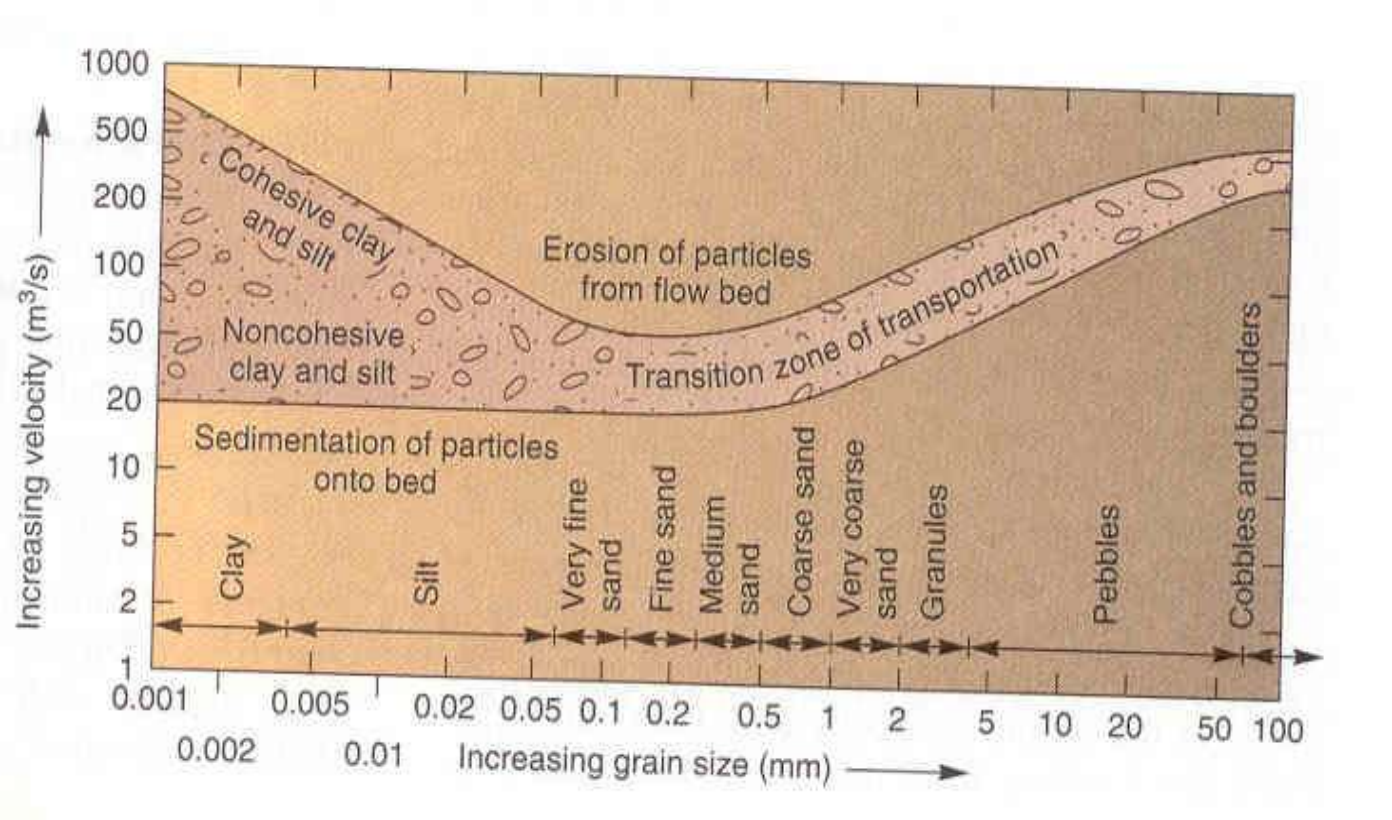
4. **Solution/Corrosion**

Certain minerals in rocks like limestone can be dissolved in water.

Rocks are then eroded.

The Work of Rivers

Relationship of velocity and sediment size to erosion



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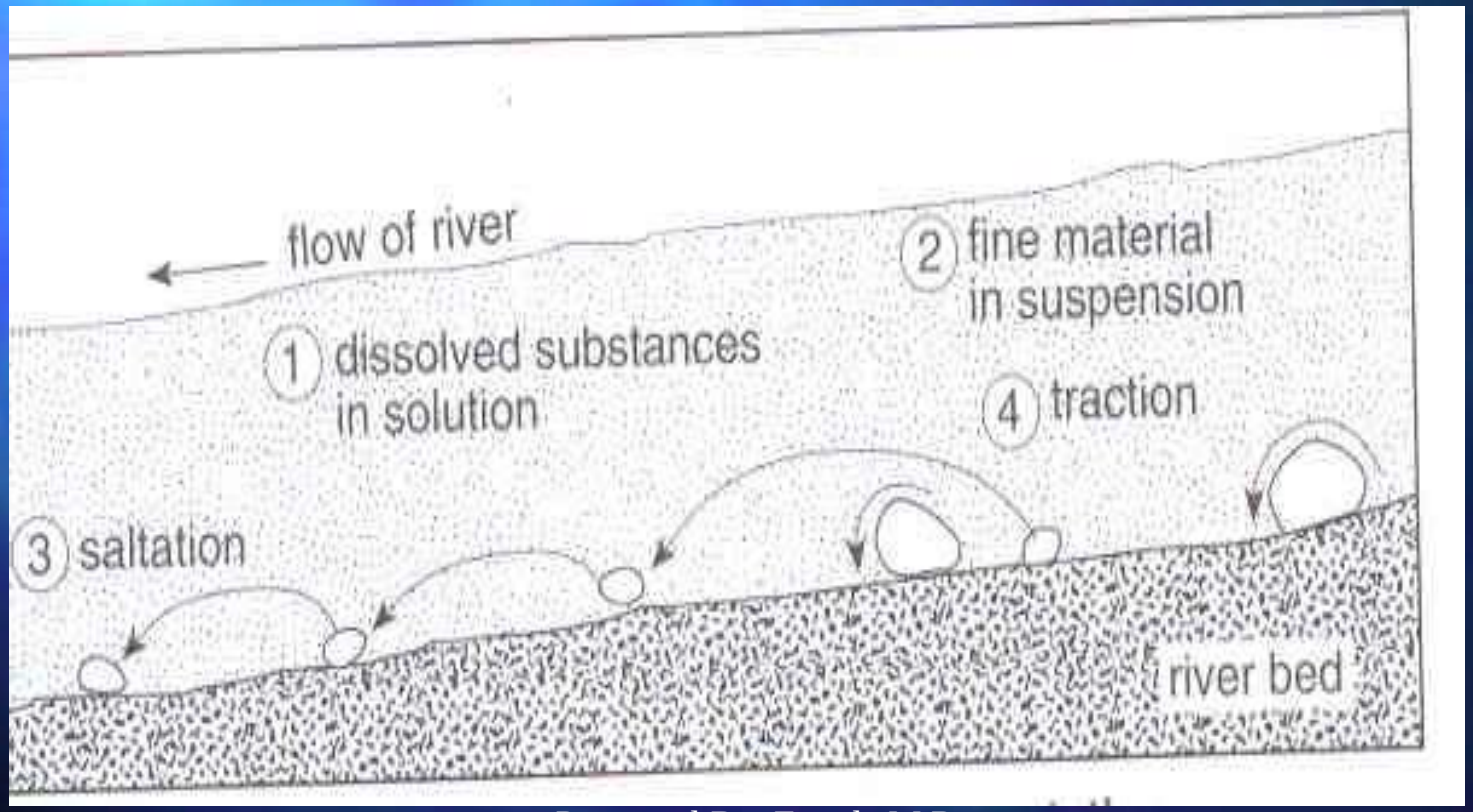
The Work of Rivers

B. Transportation (4 ways)



The Work of Rivers

B. Transportation (4 ways)

1.Traction

Larger and heavier rocks/gravels are dragged or rolled along the bed.

The Work of Rivers

B. Transportation (4 ways)

2. **Saltation (*saltim: by leaps/jumps)***

Smaller and lighter rock fragments and sand hop and bounce along the river bed.

At times, the distinction between traction and saltation may be difficult to determine.

The Work of Rivers

B. Transportation (4 ways)

3. **Suspension**

Some of the load like silt and clay (fine-grained) will float along.

They may only be deposited when stream velocity reaches near 0.

Turbulence in the water is crucial in holding a load of sediments.

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The Work of Rivers

B. Transportation (4 ways)

4. **Solution**

Some minerals are transported in dissolved form.

Especially chemical solution derived from minerals like limestone or dolomite.

The Work of Rivers

C. Deposition

A river will drop its load when:

a. Volume decreases

b. Speed decreases

The Work of Rivers

C. Deposition

A river's volume decreases when

- Dry season
- Dry region with high evaporation
- Presence of permeable rocks
- Receding flood waters

The Work of Rivers

C. Deposition

A river's speed decreases when

- It enters a lake
- It enters a calm sea
- It enters a gently sloping plain

The Work of Rivers

The work of a river depends on its energy

Energy a function of

a. Volume of water

b. Speed of water flow (dependent on gradient)

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