Course Report

Online Training Programme

On

"Natural Hazards and Anthropogenic Impacts in the Western Ghats"

(23rd - 25th February 2022)

Conducted by

National Institute of Disaster Management

(Ministry of Home Affairs, Government of India)
A-wing, 4th Floor, NDCC-II Building, Jai Singh Road,New Delhi – 110001

In collaboration with

Union of Geographic Information Technologists (UGIT)

Department of Geography and Geoinformatics

Bangalore University, Bengaluru - 560056

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National Institute of Disaster Management, Ministry of Home Affairs
In collaboration with Dept. of Geography, Bangalore Univ. and Union of Geographic Information Technologists

Jointly Organised

3-days online training programme on

"Natural Hazards and Anthropogenic Impacts in the Western Ghats"

REGISTER HERE
https://training.nidm.gov.in/

Wednesday - Friday
23 rd - 25th February 2022
2:00 pm - 4:00 pm

Presides

Prof. Venugopal K.R
Hon'ble Vice Chancellor
Bangalore University / Chairman AICTE,
South West Zone, India

Patron

Shri. Taj Hassan, IPS
Executive Director, NIDM

Guest of Honour

Prof. M. Kotresh
Registrar
Bangalore University

Keynote Speaker

Prof. Ashok D. Hanjagi
Department of Geography
Bangalore University

Invited Speakers

Dr. C.M. Lakshmana
Professor
Institute for Social and Economic Change

Dr. K.Kumaraswamy
Emeritus Professor
Bharathidasan University

Dr. Ali Raza Moosvi
Professor
Central University of Karnataka

Dr. Prabhakar B.C
Former Professor and Chairman
Bangalore University

Mr. N.Karpoorasundarapandian
Young Professional, NIDM

Dr. Shivakumar Naiklal
Scientist, KSNDMC,
Bengaluru

Dr. M. Savurirajan
Project Scientist-B
National Centre for Coastal Research

Dr.H.R. Venkatatesha
Director
Acharya Bangalore Business School

Dr. Ravindra G. Jaybhaye
Professor
University of Pune

Meeting Link: Day 1: https://zoom.us/j/93408998723?pwd=VWRkbW1JSzQ5TU03SFpRenU2SnhJdz09
Day 2: https://zoom.us/j/97268211091?pwd=RDhqNUpRS0ozendGSytuaGNwelhWQT09
Day 3: https://zoom.us/j/97606970251?pwd=MnVDbWqvWlR0eEdNbFdSQlBlVVEwQT09

LIVE STREAMING YouTube

Day 1:https://youtu.be/y9NfYSVsIaUzde5-yur6-a8k8-w3fp-9y2j
Day 2:https://youtu.be/Jddr-AOO-Rkah61-whv4-2pt0-1r66-0z50
Day 3:https://youtu.be/OVL2TzelavM4cvb-6pt3-t634-ucsa-6t3q

Organising Secretaries

Dr. Ajinder Walia
Assistant Professor, NIDM

Dr. Surendra P.
Assistant Professor, Bangalore University

PREFACE

Union of Geographic Information Technologists (UGIT), Department of Geography, Bangalore University, Bangalore has been engaged in teaching, research, organizing seminars, workshops, training programs, national and International conferences.

The Western Ghats, Older than the Himalaya mountains, the mountain chain of the Western Ghats represents geomorphic features of immense importance with unique biophysical and ecological processes. The site's high montane forest ecosystems influence the Indian monsoon weather pattern. Moderating the tropical climate of the region, the site presents one of the best examples of the monsoon system on the planet. It also has an exceptionally high level of biological diversity and endemism and is recognized as one of the world's eight 'hottest hotspots' of biological diversity. The forests of the site include some of the best representatives of non-equatorial tropical evergreen forests anywhere and are home to at least 325 globally threatened flora, fauna, bird, amphibian, reptile and fish species.

Over the past decade, there has been an increase in the frequency and severity of hazards such as droughts, flooding and cyclones. The impacts of disasters on development, poverty and vulnerability have led to calls for improving disaster resilience. At the same time, the existing methods and tools of disaster risk reduction, and climate risk management in particular, provide powerful capacities for substantially reducing risks and adapting to climate change. There is emerging evidence that disaster resilience has been effective in saving lives and protecting infrastructure, livelihoods, social systems and the environment, and that building disaster resilience is more cost-effective and sustainable than the present combination of disaster relief and development aid

It is in this context, UGIT, Department of Geography, Bangalore University has started a new MSc. Natural Disaster Management to equip our future generation to mitigate Disaster and preparedness for Disaster. The UGIT and Department of Geography has been dynamically engaged in disaster preparedness and response operations in-order to minimize or address issues of climate change. We also endeavor to develop safer communities resilient towards disasters by strengthening institutional/ individual capacities, building partnerships, identifying the disaster risk management needs, and mainstreaming risk reduction measures in our projects and programs.

ACKNOWLEDGEMENT

At the outset, I would like to express my sincere gratitude to Prof. Venugopal K.R. Hon'ble Vice-chancellor, Bangalore University, Bangalore and Shri. Taj Hassan, IPS, Executive Director, National Institute of Disaster Management, Ministry of Home Affairs, Government of India, for their leadership, encouragement and support to bring up this training programme.

I must convey my deep appreciation to Programme Co-ordinator Mr. N.Karpoorasundarapandian, Young professional from the National Institute of Disaster Management for his sincere and untiring efforts in the coordination of this training programme.

I would like to place on record significant contributions made by the resource persons associated especially Dr. C.M. Lakshmana, Dr. K.Kumaraswamy, Dr. Ali Raza Moosvi, Dr. Prabhakar B.C, Mr. N.Karpoorasundarapandian, Dr. Shivakumar Naiklal, Dr. M. Savurirajan, Dr.H.R. Venkatatesha and Dr. Ravindra G. Jaybhaye for their valued contributions in making this training programme a success and valuable.

It gives me immense pleasure in acknowledging the cooperation and support of organising Secretaries to include Dr. Ajinder Walia (NIDM) and Dr. Surendra P., in steering the proceedings of the training programme and I would like to express my sincere thanks to organizing team for a successive training programme.

I would also like to express my sincere thanks to all the participants from the different parts of the country and world who have helped us in the successful accomplishment of the training programme by being a part of it and making valuable contributions to this effort.

Last but not least, we are appreciative to NIDM, Bangalore University, for assigning us to this programme and providing guidance, motivation and extending support in many ways.

(Prof. Ashok D Hanjagi)
Chairman
(UGIT & Dept. of Geography)
Bangalore University, Bangalore

ABOUT THE INSTITUTE

Bangalore University is located in the Garden City of Bangalore aptly hailed as the "I.T. Capital of India", was established in July 1964 as an offshoot of the University of Mysore, primarily to include institutions of higher learning located in the metropolitan city of Bangalore and the districts of Bangalore, Kolar and Tumkur, which eventually became a separate university. Initially, the two premier colleges of the city, the Central College (CC) and the University Visvesvaraya College of Engineering (UVCE) formed the nucleus of Bangalore University.

According to QS University Ranking: BRICS-2016, an international agency ranked Bangalore University at 151st position amongst BRICS nations. As per ***Hansa Research Survey 2016*** published in THE WEEK-May 29, 2016 issue, Bangalore University is ranked at No. 15 in the Top Multi-disciplinary Universities at All India level, at No.9 in the Top State Multi-Disciplinary Universities, No.5 in the South Zone and No.1 in the State of Karnataka.

The inception of P.G. Department of Geography was in the year 1974-75 in the central college campus, Bangalore University. Dr. H.N. Narasimhaih the then hon'ble Vice-Chancellor and Prof. M.S. Shanthaveeraiah were behind the establishment of the Department. The Department grew initially under the stewardship of Dr. C. Naganna, the first Head of the Department. Then Dr. Daksha C. Barai was heading the Department. Later, rotation of chairmanship had been introduced.

The Department offers M.Sc. in Geography, M.Sc. Geoinformatics (Self-financed scheme), M.Sc. Natural Disaster Management (Self-financed scheme), P.G. Diploma in Geoinformatics (Self-financed scheme) and Ph.D. Programmes. There is a greater demand for the graduates from this Department and so is the Demand for the courses too. Since inception 47 Ph.D., degrees have been awarded from the Department.

The Union of Geographic Information Technologists (UGIT) is the global organization representing geographers from public and private sectors and from Universities. The UGIT is dynamic on many fronts: from the spreading of geographic research to the backing of geographic education and support with international organizations. Its head quarter is at the Department of Geography, Bangalore University, Bengaluru-56. The Union is registered academic body under Societies Registration (Regd. No. SOR/BLU/DR/955/08-09).The main aims of the union are to enrich, spread and utilization of the spatial technologies; to publish, promote and develop the use of resource, curriculum, teaching and learning materials; to popularize the Geographical Information Science and its varied applicability among the academicians and educationists in India and in the World; to save mother earth from various geo-eco hazards through enhancing these technologies; to organize conferences every year; to publish peer-reviewed research journal comprising research articles in the subject area every twice in a year.

ABOUT THE TRAINING PROGRAMME

Background

The Western Ghats are internationally recognized as a region of immense global importance for the conservation of biological diversity, besides containing areas of high geological, cultural and aesthetic values. The Western Ghats run for 1,600km in parallel with India's west coast, from Gujarat right down to Tamil Nadu at the tip of the subcontinent. It is, or was, a picturesque landscape of serene valleys, steep gorges and virgin forests. Yet, recurring floods and landslides in the mountains, hills, and areas downstream (between the Ghats and the sea) show that India must rethink its environmental law to balance the needs of nature and humans. The mountains are teeming with life. Though they cover only a small part of India's total land area, the Ghats are home to more than 30% of the country's species of plants, fish, reptiles, birds, and mammals, including both wild elephants and tigers. Its combination of unique species and habitat loss means UNESCO has recognised it as one of eight global "hottest hotspots" of biodiversity.

Climate change is already having an obvious impact, with unprecedented rains in monsoon seasons and severe drought and dry rivers in summer. And as the human population has grown, people have chopped down the forests and replaced them with spice, tea, coffee, and rubber plantations. Thousands of illegal stone quarries now also operate in the Ghats, where mountainsides are demolished to generate stones and sand for the construction industry. Deforestation and the use of highly destructive explosives mean these areas are prone to increase seismic tremors and landslides.

In this perspective, the online training programme was organized, it will give an idea of recent trends in climate change and its impact on disasters. Also, the application and advancement in the field of Geospatial technology to minimize the disaster effects. The online training programme was intended for Researchers, Academicians and other stakeholders working in this subject area.

Objectives

At the end of this course, participants were able to:

- Know the importance and value of the Western Ghats
- Understand the various aspects of physical environmental impacts.
- Gather knowledge about Geospatial technology and other advanced technologies to study the natural and anthropogenic Disasters in the Western Ghats.
- Know about the various method of assessing and evaluating disasters and its susceptibility, vulnerability and risk.
- Assess the environmental impact and ecological imbalance
- Prepare different zonation mapping for environmental mitigation and conservation plan.
- Create awareness to develop a disaster risk-free - eco-friendly environment.

Mode of Training Platform

Zoom Link for participation for all three days of the program

Day 1 (23rd Feb, 2022):
https://zoom.us/j/93408998723?pwd=VWRkbW1JSzQ5TU03SFpRenU2SnhJdz09
Meeting ID: 934 0899 8723
Passcode: 821935

Day 2 (24th Feb, 2022):
https://zoom.us/j/97268211091?pwd=RDhqNUpRS0ozendGSytuaGNwelhWQT09
Meeting ID: 972 6821 1091
Passcode: 415898

Day 3 (25th Feb, 2022):
https://zoom.us/j/97606970251?pwd=MnVDbWgvWlR0eEdNbFdSQlBlVVEwQT09
Meeting ID: 976 0697 0251
Passcode: 969027

Live on YouTube

Day 1: https://youtu.be/y9NfYSVsIaU
Day 2: https://youtu.be/Jddr-AOO-Rk
Day 3: https://youtu.be/OVL2TzelavM

Programme Schedule

Day and Date	Time	Dignitary/Resource Person	Title of Talk
	Inaugural Session		
23rd Feb 2022	2:00 – 2:05	**Dr. Abhishek MJ** Guest Faculty, Department of Geography, Bangalore University	Welcome Address
	2:05 – 2:30	**Prof. Ashok D. Hanjagi** Chairman,Department of Geography Bangalore University	Keynote Speech
	2:30 – 2:35	**Prof. M. Kotresh** Registrar, Bangalore University	Guest of Honour
	2:35 – 2:45	**Prof. Venugopal K.R** Hon'ble Vice-Chancellor Bangalore University	Inaugural Address
	Technical Session I		
	2:45 – 3:10	**Dr. H.R. Venkatatesha** Director Acharya Bangalore Business School	Suitable Industrialisation plan for Sensitive Western Ghats region.
	3:10 – 3:15	Interactions, Discussions, Q & A session	
	3:15 – 3:40	**Mr.N.Karpoorasundarapandian** Young Professional, NIDM	Vulnerability Profile Western Ghats
	3:40 – 3:45	Interactions, Discussions, Q & A session	
	3:45 – 4:10	**Dr. C.M. Lakshmana** Professor Institute for Social and Economic Change	Population Development and Environment – Regional issues and challenges
	4:10– 4:15	Interactions, Discussions, Q & A session	
	Technical Session II		
24th Feb 2022	2:00-2:35	**Dr. K. Kumaraswamy** Emeritus Professor, Bharathidasan University	A study on the Natural Disasters in the Western Ghats of Tamil Nadu
	2:35-2:40	Interactions, Discussions, Q & A session	
	2:40-3:15	**Dr. Prabhakar B.C** Former Professor and Chairman Bangalore University	Conserving the vitality of Western Ghats: need for synergised efforts
	3:15-3:20	Interactions, Discussions, Q & A session	
	3:20-3:55	**Dr. Ali Raza Moosvi** Professor Central University of Karnataka	How 'natural' are Natural Disasters in Anthropocene" with reference to Western Ghats region"
	3:55-4:00	Interactions, Discussions, Q & A session	
	Technical Session III		
25th Feb 2022	2:00-2:25	**Dr. M. Savurirajan** Project Scientist-B National Centre for Coastal Research	Anthropogenic impacts on flora and fauna in the biodiversity hotspot of Western Ghats.
	2:25-2:30	Interactions, Discussions, Q & A session	
	2:30-2:55	**Dr. Shivakumar Naiklal** Scientist, KSNDMC, Bengaluru	Disaster impact Assessment on Western Ghats
	2:55-3:00	Interactions, Discussions, Q & A session	
	3:00-3:25	**Dr. Ravindra G. Jaybhaye** Professor University of Pune	Shattered lives in restless Western Ghats: Need of Disaster Risk Reduction.
	3:25-3:30	Interactions, Discussions, Q & A session	
	Valedictory Session		
	3:30- 3:40	**Prof. Ashok D. Hanjagi** Chairman, Department of Geography, Bangalore University	Concluding Remarks
	3:40- 3:50	**Prof. Nandhini** Professor Department of Environmental Science, Bangalore University	Valedictory Address
	3:50- 4:00	**Dr. Nichitha** Guest Faculty, Department of Geography, Bangalore University	Vote of Thanks

Keynote Speech

Prof. Ashok D. Hanjagi
Department of Geography
Bangalore University

Highlights:

- ✓ **UNESCO** announced in 2012, Western Ghats is one of the biodiversity hot spots in the world.
- ✓ It is an ecological fragile ecosystem.
- ✓ Due to many anthropogenic developmental activity damage the western Ghats environments.
- ✓ To safe guard and protect the Western Ghat, Strict polices to be imposed and strengthen the existing acts like *Environmental Protection Act – 1986, and National Green Tribunal (NGT) - 2014*

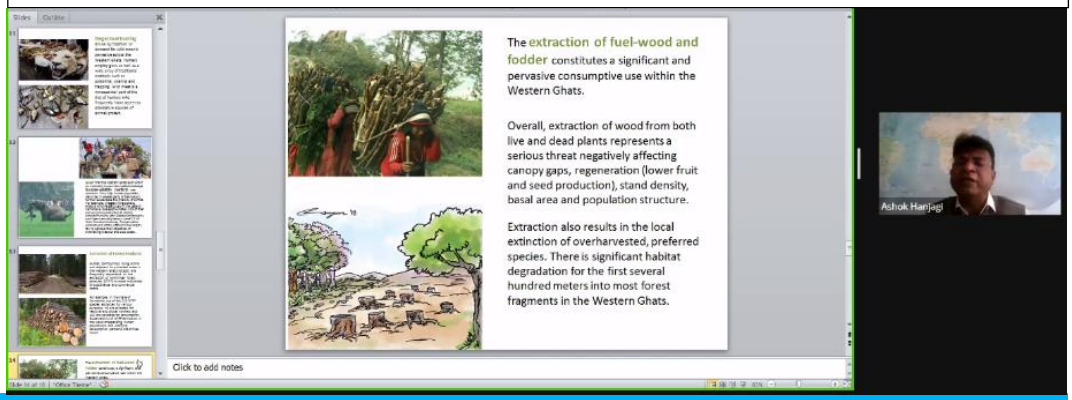
Prof. Ashok Hanjagi gave a keynote talk on **"Causes and threats of biodiversity loss in the Western Ghats"**. He emphasizes the past and the present status of Western Ghats environment and its ecosystem. Due to developmental activity how, this area has been modified and destroyed in various places. Such as hydel power plant, road and railway transportation, unchecked agro-chemicals, and dam construction (Linganamakki dam, Kali and Sarawathi) which shows there is threat increasing in this region. Ongoing projects also create to damage this ecology and environment. So, this fragile ecosystem due to anthropogenic impacts the Western Ghats is really at the dangerous zone. Power generation supply towards urban and industrial areas. Urbanization is slowly increasing; also, agricultural expansion has destroyed most the forest areas and its biodiversity. Tourism activities causes more anthropogenic impacts (construction of resorts, hotels and other recreational places).

In recent days forest fires are highly affected in the Western Ghats region during summer season. High mountain forest ecosystem is influencing the whole monsoon system and weather pattern. Due to global warming and climate change most of the nature induced disasters are happing, such as flood, landslides, and soil erosion. Last five years frequent floods and landslides were happened in this region especially in Kerala and Karnataka. Due to this several population and infrastructures damage, importantly sever biodiversity loss.

Prof. Ashok stated that similar condition exists, this region fully will get destroyed, so need to take proper monitoring and mitigation/proper conservation and management plans.

Key take away points from the topic:

- ✓ Any one should understand the basic nature of Western Ghats and it's important to form a suitable climatic condition.
- ✓ Current status of environmental degradation and biodiversity loss due to natural and anthropogenic activity.
- ✓ Implementation appropriative protection and conservation



Technical Session I (23/2/2022 @ 2:45 – 3:10 pm): Lecture I

Dr. H.R. Venkatatesha
Director
Acharya Bangalore
Business School

Highlights:

- ✓ Impacts of industrialization, materialization and commercialization.
- ✓ Focused on small and micro scale industries.
- ✓ Ecotourism
- ✓ Smoke free industries
- ✓ Organic Farming – chemical free agriculture system.

Dr. H.R. Venkatatesha delivered a talk on **"Suitable Industrialisation plan for Sensitive Western Ghats region"**. He stated with the "Small is Beautiful" when it comes to Western Ghats, it is always small, medium and micro scale industries are dominant. While selecting such industries one should be careful in the aspects of culturally, ecologically and commercially, also need to be promoting local knowledge. The strong opinion that if they are educated properly, they would add to the wealth of the forest. Pressure to commercialization, materialism and consumerism. Another industrial and commercial activity promote eco-tourism in the Western Ghats. It brings income to the locals and creates the smokeless industries, also generates employment.

Further he emphasizes the organic farming, which means pesticides, insecticides and chemical fertilizers free agricultural farming mechanism. Due to over utilization of chemical and other fertilizer land and water system will get polluted. Another important aspect is defunct industry paraphernalia (Slurry pipes), it could be used to transport water and supply in the agricultural areas. Western Ghat is known for heterogenous forest which grown naturally, so need to be stop deforestation. During the afforestation programme need not to plant acacia and other water consuming plants in the mountain's region, which collapse and make worse the environment. Also, he addressed mining and dam projects and its impact in the western ghats.

Concluded with the possible small scall industries such as ecotourism and organic farming. Also need to be educate and promote the local people to involve in the ecofriendly manufacturing industries with employability.

Key take away points from the topic:

- ✓ Educate the local people about eco-tourism and its relevant environmentally friendly industries.
- ✓ Industrial activity without spoiling the environment.
- ✓ More focus on smoke free industries.

Technical Session I (23/2/2022 @ 3:15 – 3:40 pm): Lecture II

Mr.N.Karpoorasundarapandian
Young Professional,
NIDM

Highlights:

- ✓ Western Ghat is the Greater escarpment of India.
- ✓ Susceptibility X Vulnerability = Risk
- ✓ Decadal Land cover changes
- ✓ Forest Fire

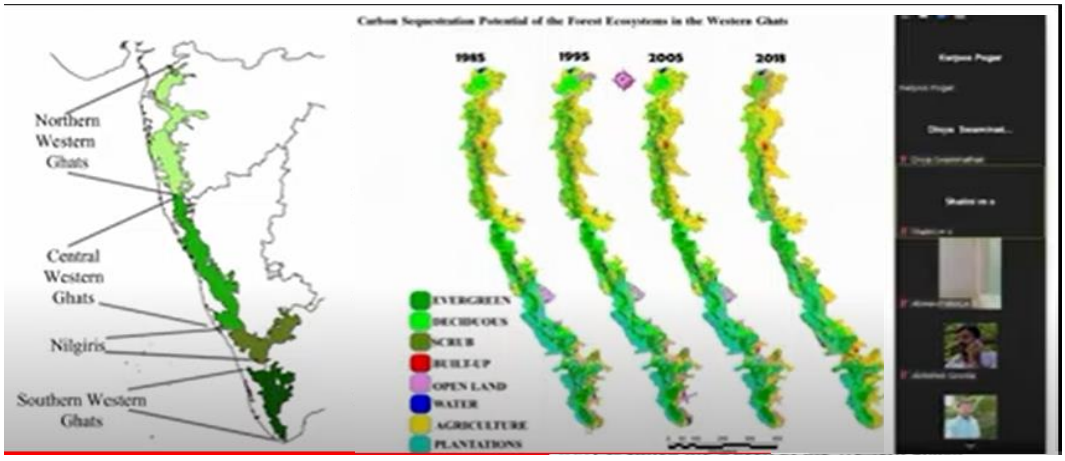
Mr. N. Karpoorasundarapandian present a talk on "**Vulnerability Profile of Western Ghats**". He explains the basic profile of the Western Ghats and its unique characteristics. The most significant of WG it's the greater escarpment of India. He describes and differentiated the vulnerability and hazard. The hierarchical structure of disaster like vulnerability, hazard, exposer, respond and risk. Also discussed various vulnerability types such as physical, social, economic, environmental and its coping and adaptive capacity.

He demonstrated various case studies related to susceptibility, vulnerability and risk factors in the different pars of the Western Ghats. Also discussed decadal land use and land cover changes (1985-2015) and its impact, mostly changes on agriculture, forest and plantation.

Further Mr Karpoora talk about the rainfall and its impacts; along with long-term forest fire in the Western Ghat region since 2008-2016 and its spatial distribution. He concluded with the Western Ghats is more prone to natural and anthropogenic hazard, which has to be monitored and assess periodically

Key take away points from the topic:

- ✓ Basic understand of Vulnerability, Hazard and Risk.
- ✓ General profile of the Western Ghats.
- ✓ Vulnerability and Risk Analysis.



Technical Session I (23/2/2022 @ 3:45 – 4:10 pm): Lecture III

Dr. C.M. Lakshmana
Professor
Population Research Centre (PRC)
Government of India,
Institute for Social and Economic Change (ISEC),
Bengaluru-560072

Highlights:

- ✓ Increased Annual rate of deforestation in WG
- ✓ Main threats to WG biodiversity: Pollution, biological resource use, residential and commercial development, dams and other natural systems modifications.
- ✓ Study says 33% of the biodiversity of the WG will be lost by 2020 due to climate change and other anthropogenic activity

Dr. C.M. Lakshmana delivered lecture on "**Population, development and environment: Regional Issues and Challenges**". He started with how interrelated aspects of population and development have in place to the resource degradation and environmental pollution. There are two major factors playing important role in this such as proximity causes and utility causes. The rapid and over population causes further damage to the ecosystem and its biodiversity, human health and well-being. The rapid urbanization and industrialization, due to that major development projects and their implications are the environmental problems.

Further, he discussed about overview of global population and its distribution. Specifically focused on urban population in the southern states which shares the Western Ghat regions. In which Bangalore (35.74%) and Trivandrum (10.59%) areas are the dominating urban population regions with in the Western Ghats. Also explained the development versus environmental degradation in India. The data clearly shows shrinking of arable land in the west and southern parts.

Also, he highlights the encroachment in the Western Ghats due to the over population. Estimated around 50 million people were living in these regions. The population in the Western Ghats is increasing with the rate of 2% every year, that resulting immense anthropogenic pressure in the buffer zone of Western Ghats.

Key take away points from the topic:

- ✓ Impact of over population, urbanization and industrialization in the Western Ghat region.
- ✓ Similarly, it causes over exploitation of the natural resources for the human need.
- ✓

Technical Session II (24/2/2022 @ 2:00-2:35 pm): Lecture I

Prof. K. Kumaraswamy
Emeritus Professor
Department of Geography
Bharathidasan University

Highlights:

- ✓ Geospatial technology a tool for decision making
- ✓ Multi- hazard Mapping
- ✓

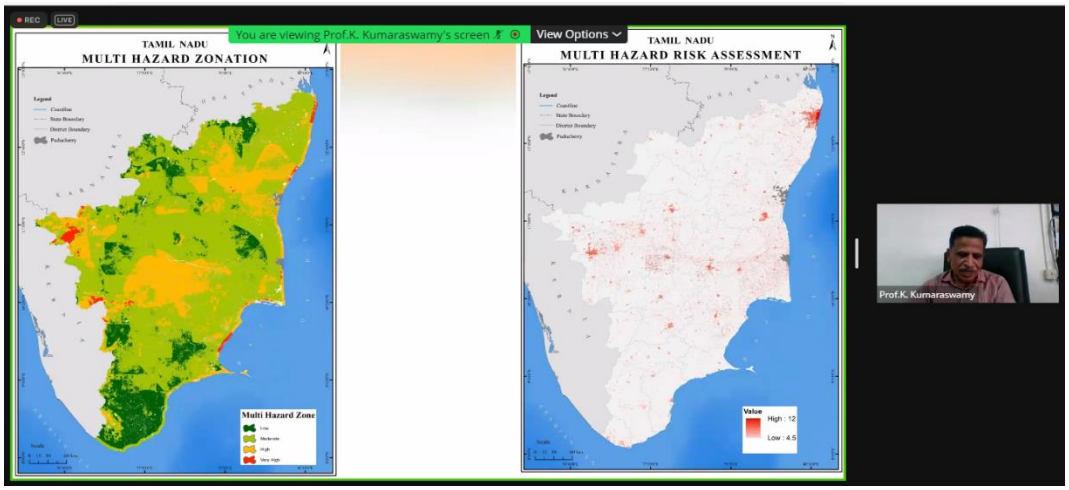
Prof. K. Kumaraswamy gave a lecture on **"Geospatial Technology in Natural Disaster Studies in the Western Ghats of Tamil Nadu"**. He started with the basics of Geoiformatics and its advantages in disaster related studies especially in Western Ghats. And emphasize the need for sustainable development in these regions. He listed out the major disaster of the Western Ghats such as landslides and flooding, Land use changes – urbanization-industries-plantation and illegal cropping, forest fire, illegal mining, transport, deforestation, mountain tourism, and encroachment of forest land and poaching of wild life.

Further he explained the major and frequent disaster events in the Western Ghats region such as landslide and floods. Followed by he described and shown the various case studies related to it. The Nilgiri and Munnar landslides are highlighted. Also shared the required data base and sources of data to study the multi hazard mapping and zonation.

The multi hazard assessment based on physical, environmental, socio-economic aspects and its impacts. Finally concluded with the application geospatial technology in the multi hazard mapping is inevitable and it helps to take quick decision-making during disaster time.

Key take away points from the topic:

- ✓ Application Geoinformatics and related domines in hazard assessment.
- ✓ Techniques of multi hazard mapping and zonation
- ✓ Geospatial technology has key to find the best solution for natural and anthropogenic disasters.



Technical Session II (24/2/2022 @ 2:40-3:15 pm): Lecture II

Dr. Prabhakar B.C
Former Professor and Chairman
Department of Geology
Bangalore University

Highlights:

- ✓ Geological importance in the WG environment
- ✓ Due to many geological and structural formation causes for the Natural disaster in WG.
- ✓ Constant monitoring and guarding against damage to WG.
- ✓ The biggest and Unique biosphere zone in India.
- ✓ Synergising the conservation efforts

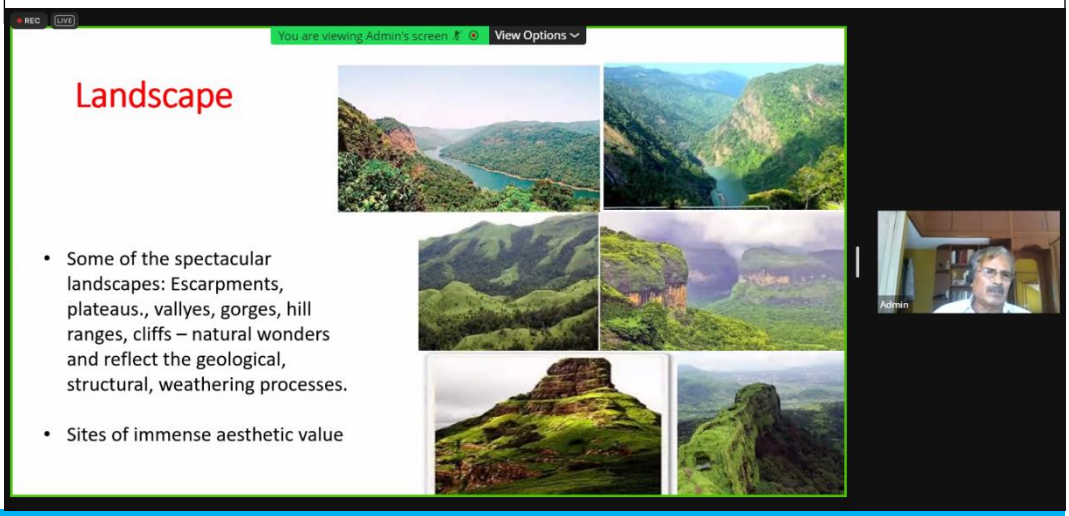
Dr. Prabhakar B.C delivered a talk on **"Conserving the vitality of Western Ghats: need for synergised efforts"**. He started with the present-day global challenges, that are development and environment. Here comes the major challenges like better materialistic comfort to providing basic sustenance versus caring for our natural surroundings. Followed by sustainable development goals, out of 17 SDG, six are directly related to environment such as life on land, climate action, responsible consumption & reproduction.

He emphasizes the geological importance of the Western Ghats, because it's formed during the breakup of Gondwanna supercontinent ~150 million years ago. Also, it has various natural and spectacular landscapes such as escarpments, plateaus, valleys, gorges, hill ranges, cliffs – natural wonders and reflects the geological, structural and weathering process. These are one-way other way make important influential factor for the natural disasters like landslide, earthquake, and floods.

Further Prof. Prabakar discuss about the importance of biodiversity richness in Western Ghats and it challenges. Continue that he explains the human induced hazards and consequences. Concluded with the east or west, north or south throwing environmental norms in to air is the order of the day in India! - because no fear of law and population pressure. In addition to that, we have not fully realized the vitality of Western Ghats yet, for our sustenance and well-being. And should be realize before it is too late – because recovery time may be hundreds or thousands of years

Key take away points from the topic:

- ✓ Understand the geological and environmental relationship towards better living.
- ✓



Technical Session II (24/2/2022 @ 3:20-3:55 pm): Lecture III

Prof. Ali Raza Moosvi
Professor
Central University of Karnataka

Highlights:

- ✓ High biodiversity and endemism
- ✓ Understanding 'Anthropocene the recent age of man.
- ✓ The Anthropocene is supposedly a golden age for humankind.

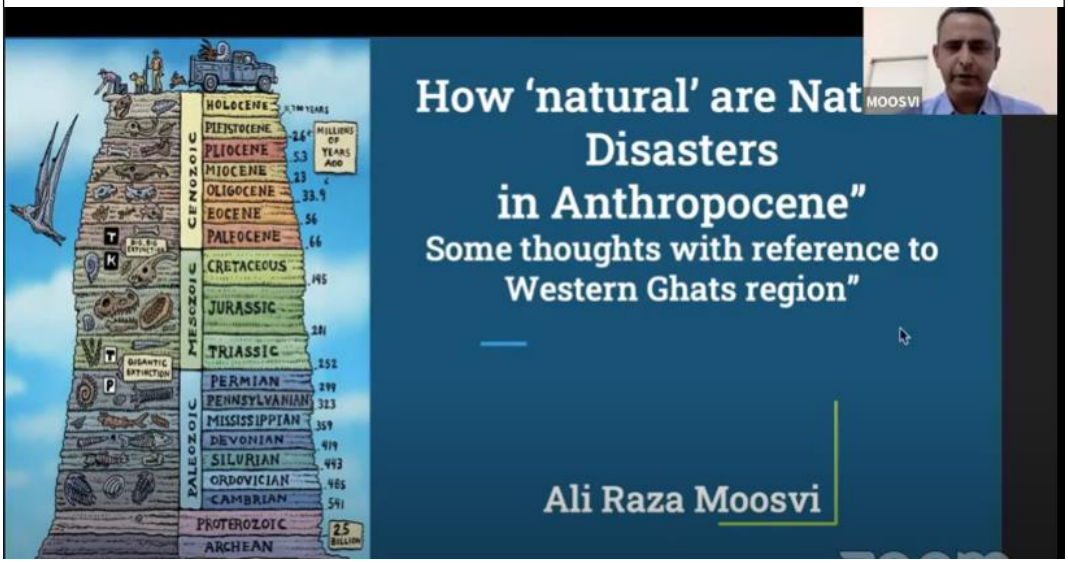
Prof. Ali Raza Moosvi gave a lecture **on "How 'natural' are Natural Disasters in Anthropocene" with reference to Western Ghats region".** He emphasizes the growing timeline from capacity to hazard and make understand the connectivity and relationship between each other. He showed and explain the various vulnerability maps from the vulnerability atlas of India 2019 (GoI) such as Landslide incidence Map, Flood hazard map, cyclone occurrence map, thunderstorm incidence map, earthquake hazard map, and wind hazard map. With the special case study of Kerala flood (A result of poor Dam management) and Ockhi (Dec 2017) & Taukta (may 2021) cyclones.

Also, he discussed, how 'natural' are these hazards. Stated with the question like are they the result of normal geomorphic or geological agents? Are they the result of a natural timeline and time cycle?

Further explained the idea of Anthropocene from Conrad to Orwell. A geographical concept that is rooted in the idea of possibilism where humans believe that they are free to act in world without consequences because natural control that is determinism. Finally, he concluded that human have been impacting the earth in many harmful ways such as human impact on biodiversity, increases in global rates of extinction, changes in drainage pattern and climate change with reference to Western Ghats. It is across subject matter; how do we integrate human knowledge and try to make sense. We don't realize the earth nature and we have lost the ability to listen to what the earth is saying.

Key take away points from the topic:

- ✓ How mankind evolved, developed and sustained in the earth.
- ✓ The hazards formed the results of geomorphic and geologic events.



Technical Session III (25/2/2022 @ 2:00-2:25 pm): Lecture I

Dr. M. Savurirajan
Project Scientist-B
National Centre for Coastal Research

Highlights:

- ✓ The WG is a home of global threatened flora and fauna.
- ✓ This region is more vulnerable due to anthropogenic activity.
- ✓ WG consists of national parks and sanctuaries.
- ✓ Elephant conservation and relief camps
- ✓ Tiger reserve

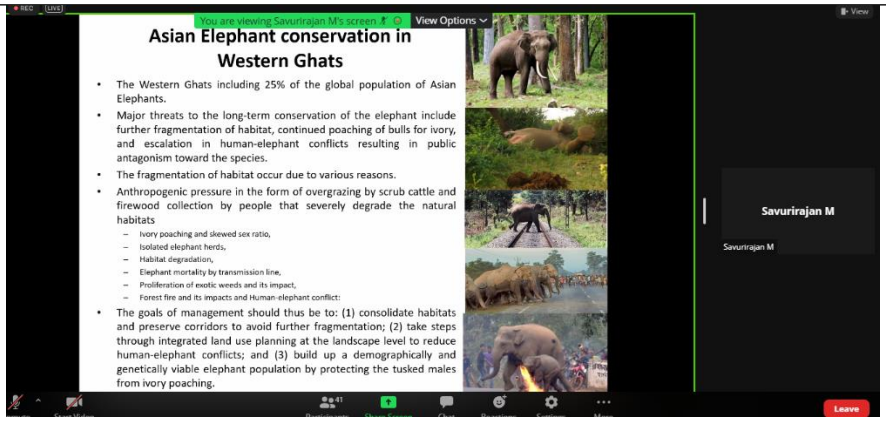
Dr. M. Savurirajan gave a talk on **"Anthropogenic impacts on flora and fauna in the biodiversity hotspot of Western Ghats".** He started with overview and general glance of WG and its hottest hotspots. It is a home of at least 325 globally threatened flora, fauna, bird, amphibian, reptile and fish species. Highlighted the endangered species such as the lion-tailed Macaque, Nilgiri Tahr and Nilgiri Langur are unique to the area. Also explain the habitat loss due to anthropogenic activity, there were many private plots of land which had many trees, but these have been turned into housing complexes or tourist resorts.

He discussed the natural causes like climate change, which causing stronger and more erratic rainfall with recurrent floods in the low-lying areas. The impact of climate change, unpredicted rainfall in monsoon seasons and sever drought and dry rivers in summer. All this makes flooding more sever, as deforestation in the catchment area, river reduces the lands' ability to retain water.

The major anthropogenic activity and its impact in the WG are livestock grazing, illegal hunting, human-wildlife conflict, extraction of forest products, fuelwood and food extraction and plantation. Further he emphasis the Asian elephant conservation in WG with its various management practices. Similarly, tiger reserves also equally important in this region. Also, highlighted the threats to vegetation in WG, from 1920-1990, 40% of original natural (native) vegetation was lost. Finally concluded with the best solution to conserve the biodiversity in the WG.

Key take away points from the topic:

- ✓ Western Ghats natural capacity and vital role in the ecological balance and enrich the biodiversity.
- ✓ How human or anthropogenic activity collapses / threaten to the WG environment.
- ✓ Understand the man-animal conflict and its protection and conservation management.



Technical Session III (25/2/2022 @ 2:30-2:55 pm): Lecture II

Dr. Shivakumar Naiklal
Scientist, KSNDMC,
Bengaluru

Highlights:

- ✓ Vulnerability overview of Karnataka
- ✓ Working principles of Weather monitoring station designed by KSNDMC.
- ✓ Detailed rainfall, flood analysis, frequency and its patters.

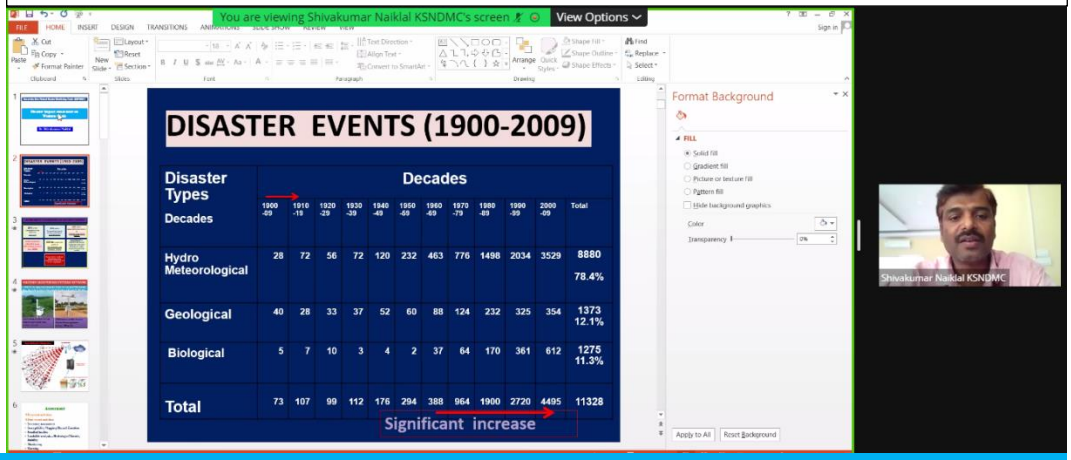
Dr. Shivakumar Naiklal delivered a lecture on **"Disaster impact Assessment on Western Ghats"**. The lecture was started with historic (1900 - 2009) disaster events and its types, such as Hydrometeorological (78.4%), Geological (12.1%), and Biological (11.3%). Followed by the overviewed the vulnerability of Karnataka states natural disasters. 80 % of the area is prone to drought, Earthquake (22%), cyclone and heavy wind (24%), coastal erosion and tsunami threat (359 km long coast line).

He demonstrated and explain the functionality of weather monitoring station network designed by KSNDMC. The hydro-meteorological hazards are recurring very frequently and with increased in the strength of the SW monsoon and distribution of rainfall. Due to this frequently flood events are common. Further he explained the flood forecast system in the western ghats region. Also discussed the utilization of high-resolution hyperspectral data (Sentinal 1- synthetic Aperture Radar - SAR) in the identification of flood affected and inundation areas during the flood scenario.

The landslides are also an important disaster event in the WG areas during the monsoon season, which leads the slope saturation by water, decreased the effective cohesion and generate the hydrostatic pressure in the soil profile allowing significant slope failures. Human induced mass movement subjecting a slope to a load that exceeds its ability to resist movement. The proper disaster assessment to be carried in the frequent disaster occurring regions, forecast and predict the vulnerability scenarios and prepare the appropriate managements plans.

Key take away points from the topic:

- ✓ Historic disaster events and its impact.
- ✓ Natural Disaster overview of Karnataka state.
- ✓ Rainfall and flood forecasting, prediction and assessment of flood inundation.



Technical Session III (25/2/2022 @ 3:00-3:25 pm): Lecture III

Dr. Ravindra G. Jaybhaye
Professor
University of Pune

Highlights:

- ✓ The Western Ghats: Rich in biodiversity and Cultural heritage
- ✓ Ecological fragile area
- ✓ Man-animal conflict
- ✓ Disturbance index
- ✓ Forest vulnerability index
- ✓ Disaster risk reduction

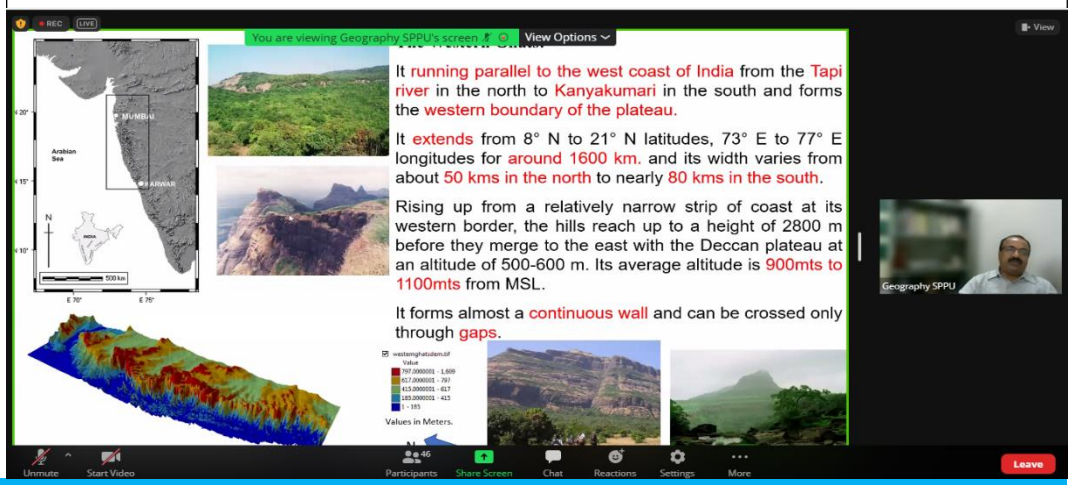
Dr. Ravindra G. Jaybhaye gave a speech on **"Shattered lives in restless Western Ghats: Need of Disaster Risk Reduction"**. He started with an overview of Western Ghats, and its unique physical characteristics and cultural heritage (historic structures). The biodiversity, hydrological function, climate and climate change has playing important role in the WG. Hence, WG faces lots of ecological disturbance and biodiversity loss. It contains exceptional levels of plants and animal diversity and endemicity, around 52 of tree species and 65% of amphibians are endemic.

The economic importance of the WG is rich in iron, manganese and bauxite, medicinal plants and spices. Forest based industries and non-timber forest products (NTFP). At the same time, the developmental activity and its related substance will damage and spoil the environment. The plantation activity is source of fragmentation of natural habitat, and encroachment by human settlements. The unrestricted use of agrochemicals causes serious damage to aquatic and forest ecosystem. Hydropower projects and large dams in WG resulted in environmental and social disruption.

Further Dr. Jaybhaye discussed man-wildlife conflicts with the case study of Junnar forest division between (2008-2014). Also, he explained the calculation and interpretation disturbance index. Distribution of forest vulnerability index and their impacts. He discussed the global natural disaster raise with in last 50 years, India is the third country in the world in terms of the number of natural disasters. The case study of Kerala flood and its impacts were shared. The final statement of the lecture was, to concentrate the disaster risk reduction, reduce the main-animal conflicts and the protect the environment throw appropriate policy.

Key take away points from the topic:

- ✓ Understand the physical and cultural relationship in the WesternGhats.



Valedictory Session (25/2/2022 @ 3:30-4:00 pm)

Valedictory Address

Prof. Nandini N
Professor
Bangalore University

Prof. Nandini N delivered the valedictory address in the **"Natural Hazards and Anthropogenic Impacts in the Western Ghats"** training program. Every important concern about loss of biodiversity, climate change and loss of natural resources especially in the hotspot of the Western Ghats. Highlighted the human interferences, habitant loss development activity take place the cost of biodiversity. Because of the human activity, encroachment for settlement, agricultural purposes and mining. Due to that several environmental issues such as destruction of land, emission, uprooting of trees, loss of native species and changes in the land use pattern. In this cause need a better sustainable management practice includes implementation and monitoring and make policies. As the role of academician and young researchers to know what are the legislations that enforced and how it is getting amended. Also know who has implemented and monitored. Think to develop an eco-friendly environment through sustainable manner.

Concluding Remark

Prof. Ashok D. Hanjagi
Chairman, Department of Geography, Bangalore University

Prof. Ashok D. Hanjagi concluding remark of the three days **"Natural Hazards and Anthropogenic Impacts in the Western Ghats"**. Western Ghats is Green Gold Land, fragile ecosystem biodiversity rick hot spot. He summing up three-day lectures and discussed the important aspect of biodiversity, climate change, natural hazard, human – wildlife conflicts. This is the time every one of us think and join together to safeguard our one and only the Western Ghats and its biodiversity richness for the future generation. Prof. Ashok thank all the resource persons for their valuable and informative talks. Also, thanked the NIDM and Bangalore university authorities for their tremendous support to successfully complete the programme.

Registered Participant list

	Full Name	Email
1	Mr. Shrey Asati	2021murp019@spab.ac.in
2	Aastha .	aasthaa191@gmail.com
3	Abdul Rahaman S	abdulatgeo@gmail.com
4	Abhiman Singh	abhimanaabhiman@gmail.com
5	Abhishek M J	abhishek.can@gmail.com
6	HARESHKUMAR MAGANBHAI	adv.hmkoladiya21@gmail.com
7	R. S. Ajin	ajinares@ieee.org
8	Ankhi Saha	akhee.saha@gmail.com
9	akhila sen	akhila@nirmalacollege.ac.in
10	MD. SOHRAB ALI	ali.md1016@gmail.com
11	Ali Younes	aliyounes@geography.uni-mysore.ac.in
12	Alok Gupta	alokgprince01@gmail.com
13	AMAN KUMAR BHAGAT	amankumarbhagat5@gmail.com
14	AMIT ALOK	amitalok2@gmail.com
15	Anandhi L	anandhicvl@gmail.com
16	Angelita Noses	angelitaknowcease@gmail.com
17	ANJU K	anjukaruthedam@gmail.com
18	Arvind Chauhan	arvindchauhan.chauhan081@gmail.com
19	Arya S Somaja	aryassomaja@gmail.com
20	Ashvini Khetmalas	ashvinist@gmail.com
21	Amol Shinde	asshinde23@gmail.com
22	SUJOY KANTI BHATTACHARJEE	avtarsujoy1988@gmail.com
23	A MD zameer Hussain basha basha	azameer786313@gmail.com
24	Nageswari B	bgeethaiyer@gmail.com
25	Bharati Madhekar	bharti.madhekar@gmail.com
26	BIPLAB AUDDYA	biplabauddya123@gmail.com
27	Subhasree Biswas	biswassubhasree58@gmail.com
28	BIJAY KUMAR KAYAL	bk8942983498@gmail.com
29	Shailaja Bommishetti	bommishettishailaja@gmail.com
30	Brijendra Kumar	Brijendra253@gmail.com
31	Bapurao Sahadeo Dongre	bsdongre388@gmail.com
32	Chaitra Nagammanavar	chaitramn30@gmail.com
33	Chanchal Kulkarni	chanchalkulkarni03@gmail.com
34	Archana Das	dasarchana875@gmail.com
35	DEEPAK KUMAR DUBEY	deepak.dubey97@gmail.com
36	DEEPIKA A	deepika@sethu.ac.in
37	Divya Sharma S G	divyasharma.sg@gmail.com
38	Divya Rajeswari Swaminathan	divyaswaminathan2019@gmail.com
39	DINESH KUMAR	DK7548248@GMAIL.COM
40	Dona Joy	donajoy1996@gmail.com
41	Dr. Dinesh Pandit	dpandit@hotmail.com
42	DR PROF ING GURUDUTT SAHNI	drguruduttsahni@rediffmail.com
43	Dr. Harendra Kumar	drharendra1982@yahoo.com
44	MANORANJAN NAYAK	drmnayak007@gmail.com
45	Dr. Namdev Gajre	drnngajre@gmail.com
46	Dr.Shiva Kumar R.	drshivakumarrajendra@gmail.com
47	Sanjeev Gupta	fdpsanjeevpreeti@gmail.com
48	GURUDATH B S	gdath35@gmail.com
49	GOPAL BANSAL	gopalbansalgzb@gmail.com
50	Kaushalendra Prakash Goswami	goswamikp2004@gmail.com
51	VAIBHAV GOYAL	goyal999@outlook.com
52	GANI SHARMILA BANU	gsharmilabanu@gmail.com

Registered Participant list

53	Gurpreet singh Talwandi	gtalwandi13@gmail.com
54	GURUDAS BAROI	gurudas22051999@gmail.com
55	Harish .	Harishdhawan1998@gmail.com
56	Hemanth G	hemanthghemu9845@gmail.com
57	Harbakhash Singh	hs.civildefence@gmail.com
58	Vandana Shelke	Jspmstd12@gmail.com
59	Kajal Kumari	kajal.kumari66901@gmail.com
60	SALESH KALKAL	kalkalsalesh@gmail.com
61	Abhay Kumar	kr.abhaykumar@gmail.com
62	Kumar Ganesan	kumarg@hku.hk
63	LALIT KUMAR YADAV	lalit585@gmail.com
64	Lal Mohammad	lalmohammadwb@gmail.com
65	JAYDUTT PATHAK	language.1@billimoriahighschool.com
66	Jayamani Lawrence	lawrence.lawru@gmail.com
67	Dr. Chandraban Bhanudas Chaudhari	lcdchaudhari@gmail.com
68	AKHILESH KUMAR GOUTAM	lecturer_akhilesh@outlook.com
69	Lois Ghosh	lois.ghosh@yahoo.com
70	Bikram Mondal	M6bikram@gmail.com
71	Madhu B	madhugowda4015@gmail.com
72	Madhu Solanki	madhukuntal448@gmail.com
73	Mahadeva M	mahadevm10@gmail.com
74	Pushpraj Singh Rajawat	majpsr@gmail.com
75	Manjula Singh	manjulasngh1@gmail.com
76	Manoj Kumar Jha	manoj61367@gmail.com
77	Jayesh Madhursinh Matani	mataniquiz@rediffmail.com
78	Nagaraju K	mr.nograj@gmail.com
79	Mrinal Jyoti Bora	mrinalbora23@gmail.com
80	Y. MADHU SUDHANA	msmsc1986@gmail.com
81	Megha N. Nair	nairmeghan@gmail.com
82	Nalineesh Kumar Singh Yadav	nalineesh6995@gmail.com
83	Neha Gautam	neha.gtm19@gmail.com
84	Nidheesh K S	nidheeshks.sb@gmail.com
85	Dr. Nischitha V	nischithav@gmail.com
86	NKEMNDEM AGENDIA DEMIANUS	nkemndem23@gmail.com
87	Oliver Pinto	Oliveratwork@gmail.com
88	DR MOHAMMED OSAMA	osama4447@gmail.com
89	MPUDC PIU Morena	piumorena@yahoo.com
90	Pushpa Patil	pntpatil2006@gmail.com
91	Prakhar Tripathi	prakhar2419tripathi@gmail.com
92	PRATIBHA KALE	pratibhadkale77@gmail.com
93	Pratima Ekka	pratimaekka022@gmail.com
94	RAHUL KAMBLE	primary.2@billimoriahighschool.com
95	MEETA PATHAK	primary.7@billimoriahighschool.com
96	Priyanka Borade	priyanka.borade@podar.org
97	Mithilesh Chavan	prof.mithilesh.chavan@gmail.com
98	Pugazhenthi Velraj	pugalserfoji@gmail.com
99	Sunitha C	pugalsunitha@gmail.com
100	Rajan Kumar	rajan.sharmanov1991@gmail.com
101	Rajan Kumar Singh	rajansingh885876@gmail.com
102	Rajdeep Bansod	rajdeep.tiss@gmail.com
103	Raj Shaikh	rajshaikh.rs2151@gmail.com
104	Raj Singh	rajthakurknp@gmail.com
105	RAJVEER SINGH	rajveersingh80001@gmail.com

Registered Participant list

106	DEGA RAM NARESH YADAV	ram.phy1991@gmail.com
107	Rameez Ahmad Sudhan	rameezsuden@gmail.com
108	RAMESH P	rameshketpoly10@gmail.com
109	Dr Rani Singh	raniprasadsingh@gmail.com
110	THIYAGARAJAN RADHAKRISHNAN	rashmithiyagu@gmail.com
111	RAVI AGARWALLA	raviagarwalla2020@gmail.com
112	Ravindra Hande	ravihande11@gmail.com
113	RAVINDRA REDDY M	ravindraoudeptsw@gmail.com
114	R GAGAN DEEP	rgagandeepa@gmail.com
115	RIYA AUDDYA	riyaauddya123@gmail.com
116	Roop Singh Dhakad	roopsinghdhakad@gmail.com
117	RUBINA KHATUN	rubinakhatun.Chakai@gmail.com
118	Rupali Chothe	rupalichothe91@gmail.com
119	LUBNA SIDDIQUI	s_lubna2004@yahoo.co.in
120	Sadhana Suryawanshi	Sadhanasuryawanshi7192@gmail.com
121	Sajjan Singh	sajjans14@gmail.com
122	ALBERT NONGHULOO	samarasalert@gmail.com
123	Dr. Sandhya Kumari R	sandukumari400@gmail.com
124	DEEPAK SINGH CHAHAR	sandy786candy@gmail.com
125	Sangita Ghosh	Sangitaghosh857@gmail.com
126	sanket jnarao	sanketj98@gmail.com
127	NAZIR AHMAD MIR	saqbnazirs602@gmail.com
128	Ganapathy Pattukandan	seismogans@yahoo.com
129	Sejal Gandhi	sejal.dalal210793@gmail.com
130	SANDIP NANDKUMAR GOMTE Gomte	sgomte@gmal.com
131	SHAH RAHUL RAMKISHAN	shahrahul1591996@gmail.com
132	SHANKARA ..	shakubale@yahoo.com
133	Shalini Jain	Shalnij4021989@gmail.com
134	Sharath Hulihalli Manjunath	sharathhm92@gmail.com
135	Harshita Sharma	sharmaharshita13122000@gmail.com
136	Sheetal Jadhav	sheetaljadhav7719900746@gmail.com
137	NEERAJ KUMAR	sheotajsingh874@gmail.com
138	SHIVAMADAIAH SHIVAMADAIAH	shivamadaiah@gmail.com
139	Shubhangi Sutar	Shubhangi1786@gmail.com
140	Swetabh Hanjagi	shwetabhahanjagi@gmail.com
141	Sibsankar Mal	sibsankarmalgeo@gmail.com
142	Simran Sahu	simransahu8887@gmail.com
143	Pratibha Singh	singhpratibha708076@gmail.com
144	DR SK ALAMGIR BADSHA	sk.alamgir27@gmail.com
145	Sneh Gangwar	sneh_geo2005@yahoo.co.in
146	Sneha Bharti	Snehanew1998@gmail.com
147	Dr. Somnath Raut	somnath.raut1979@gmail.com
148	Soumyajit Halder	soumyajit.halder1989@gmail.com
149	Jujjuvarapu Sravani	sravaniju320@gmail.com
150	SEELA SREENUVASARAO	sreenuvrao4881@gmail.com
151	Sarath SR	srsarath6396@gmail.com
152	Sudip Roy	ssudiproy1725@gmail.com
153	MALLIKA B	success.mallika@gmail.com
154	Supriya Roy	supriyaroy145@gmail.com
155	Dr. Surendra P	surendrabub@gmail.com
156	swati Walse	swatipwalse@gmail.com
157	Tins Ravi	tinsravi4hockey@gmail.com
158	P. RAMA THULASI	tulasicbit@gmail.com

Registered Participant list

159	Uma Sundari Puspanjali	umasundari1980@gmail.com
160	VIJAYA BADGUJAR	vijayabadgujar85@gmail.com
161	VIPAN KUMAR	vipanpuchd@gmail.com
162	VIRENDRAKUMAR THAKKAR	virendrakumarthakkar@gmail.com
163	VISHA LAKSHMI SRIKAKOLAPU	visha.prasad@gmail.com
164	Vineet Kumar	vkgeog@gmail.com
165	VRITANT GUPTA	vritantgupta@yahoo.com
166	Manjunath R	vu3cjm@gmail.com
167	Ganesh Yadav	yadavganesh83302@gmail.com
168	Yash Kumar Sharma	Yash.272.sharma@gmail.com
169	ARYA K	aryakp2812@gmail.com
170	Athulya M	athuvinublathur@gmail.com
171	Holly Dehingia	dehingiaholly@gmail.com
172	Devika vs	devikavsgowda123@gmail.com
173	Sushant Sawant	geo_sushant@jssuni.edu.in
174	Gopika S Nath	gopikasnath1999@gmail.com
175	PRAVEEN KUMAR	gpraveen117@gmail.com
176	Hemanth G	hemanthghemu9845@gmail.com
177	SHILPA O T	itsmeshilpaot@gmail.com
178	Suzan Karmoka	Karmoka.suzan@hotmail.com
179	RIMA RANI DAS	rimadas0666@gmail.com
180	SHILPA S	shilpasurendra1998@gmail.com
181	Sovagini Talukdar	sovaginitalukdar6097@gmail.com
182	Anitha V m	vm.anitha97@gmail.com
183	Vishwanath B C	vishwabc.mandya@gmail.com
184	Harish H.S.	haarishhs.geo@gmail.com
185	Nimisha T S	nimishasrinivasan@gmail.com
186	sadhana suryawanshi	sadhana.suryawanshi7192@gmail.com
187	Sangita Ghosh	sangitaghosh857@gmail.com
188	RUBINA KHATUN	rubinakhatun.chakai@gmail.com
189	Meghana MB	meghanamb058@gmail.com
190	Chand Sardar	sardarchand18@gmail.com
191	Holly Dehingia	dehingiaholly@gmail.com
192	Dr. Minutha V	minumini89@gmail.com

Resource Material

The remaining natural ecosystems of this mountain range are subject to a number of threats that vary widely in the nature and intensity of their impacts on biodiversity.

They include:

Livestock grazing within and bordering protected areas by high densities of livestock (cattle and goats) is a serious problem because it causes habitat degradation. Growth in livestock densities often accompany human population growth, resulting in serious conflicts between villagers and forest department officials.

Illegal local hunting driven by tradition or demand for wild meat is pervasive across the Western Ghats. Hunters employ guns as well as a wide array of traditional methods such as poisoning, snaring and trapping. Wild meat is a nonessential part of the diet of hunters who frequently have access to alternative sources of animal protein.

Extraction of Forest Products:

Human communities living within and adjacent to protected areas in the Western Ghats hotspot are frequently dependent on the extraction of non-timber forest products (NTFP) to meet a diversity of subsistence and commercial needs.

For example, in the state of Karnataka, out of the 310 NTFP species extracted for various purposes, 40 are collected for regional and global markets and 110 are collected for consumption. Sustainability of NTFP extraction in the wake of expanding human populations and changing consumption patterns are critical issues.

WG are under tremendous pressure

- Scarcity of drinking water during summer
- Reduction of groundwater table.
- Reduction of forest resources.
- Siltation of tanks, drying up of rivers and springs, invasion of eupatorium.
- Increase in monoculture plantations of teak , rubber, eucalyptus.
- Changes in agriculture practices and crops pattern.
- More commercial crops are grown.
- Damaging crops by wildlife - Elephant, wild boar & monkey.
- Traditionally conserved by small populations of indigenous people leading sustainable lifestyles, the area is under increasing population and developmental pressure.
- The pressure from human populations - 50 million people are estimated to live in the Western Ghats Region.

How to protect the western Ghats

India's 1950 constitution claims that protection of the environment is a fundamental duty of every citizen, and though it does not explicitly contain a right to a clean environment, legal authority for environmental law-making is derived from the document.

Over the years, the country's central government has enacted various laws that are applicable to the Western Ghats:

- **the Environment Protection Act 1986,**
- **the Forest Conservation Act 1980,**
- **the Biodiversity Conservation Act 2002** and so on.
- National Green Tribunal (NGT) in 2014

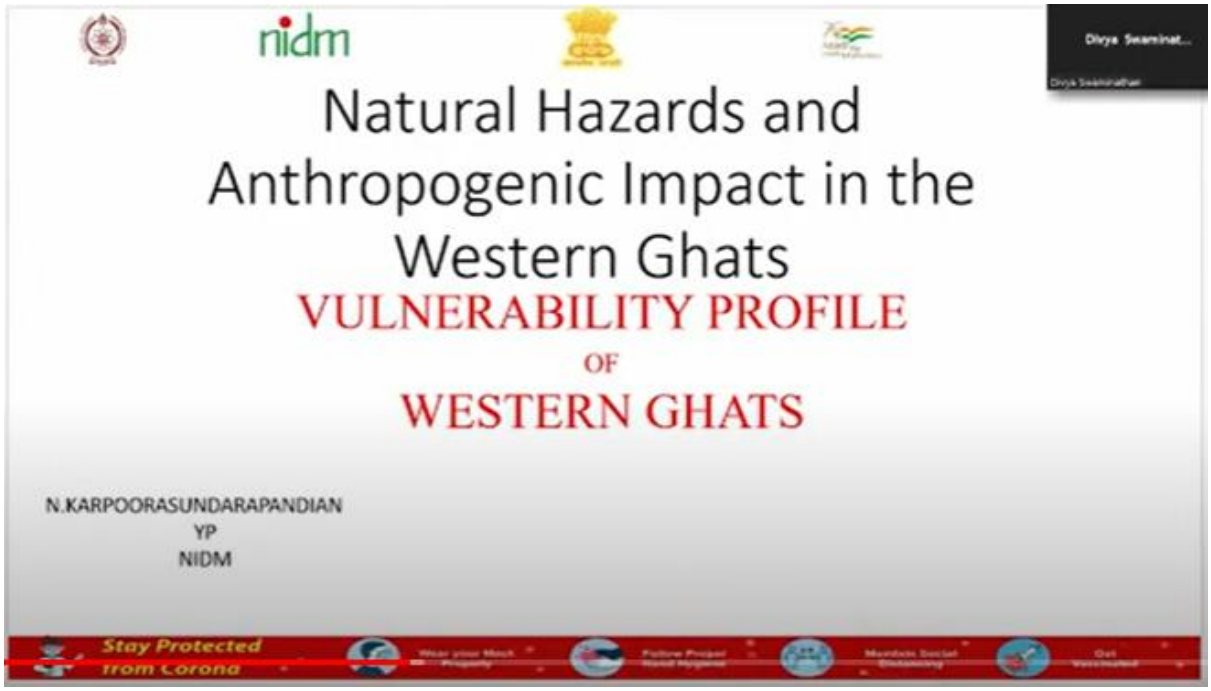
Some of the major floods in the past couple of years happened after dams were opened, letting water flow downstream into another area.

Similarly, discussions over climate change and environmental law-making should involve more grass-root level participation. For most people, poverty and earnings still matter more than climate mitigation or adaptation. Hence people's perception should be moulded to recognise and realise how deforestation or climate change impacts their daily life. To protect the Western Ghats, what we require is an attitude that recognises the significance of these mountains, and that will involve specific laws.

SUSTAINABLE INDUSTRIALIZATION PLAN FOR SENSITIVE WESTERN GHATS

WHAT INDUSTRIES?

- Small is Beautiful
- Promote Local Knowledge
  - Mango pickle
  - Sandal wood carvings
  - Bamboo products
  - Cane product
  - Forest produce- Tribal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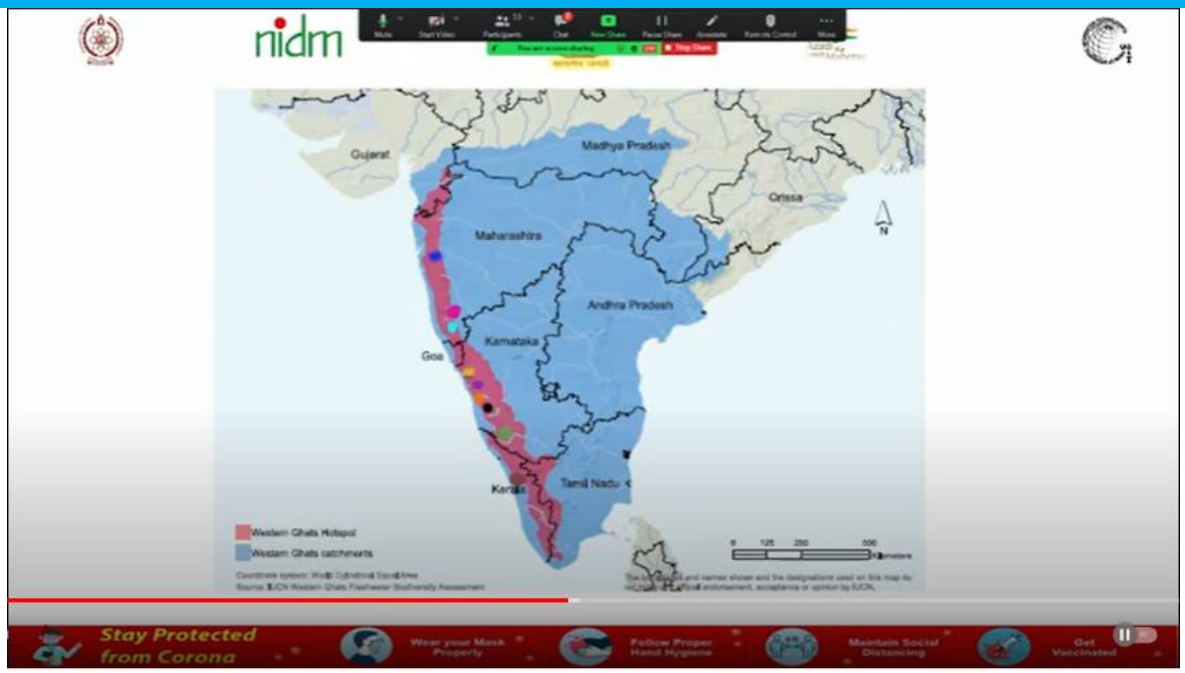
South Asia
India
Western Ghats in India
Gujarat
Dadra & Nagar Haveli
Maharashtra
Karnataka
Goa
Kerala
Tamil Nadu
Western Ghats
State / UT boundary
The Great Escarpment of India
The Western Ghats is a mountain range that covers an area of 160,000 km2 (62,000 sq mi) (South to North)
1,600 km (990 mi)(West to East) parallel to the western coast of the Indian peninsula
The range runs north to south along the western edge of the Deccan Plateau and separates the plateau from a narrow coastal plain called Konkan along the Arabian Sea
The catchment area for complex riverine drainage systems that drain almost 40% of India.
The Western Ghats block the southwest monsoon winds from reaching the Deccan Plateau.
The average elevation is around 1,200 m (3,900 ft)
Stay Protected from Corona


nidm
Gujarat
Madhya Pradesh
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Kerala
Western Ghats Hotspot
Western Ghats catchments
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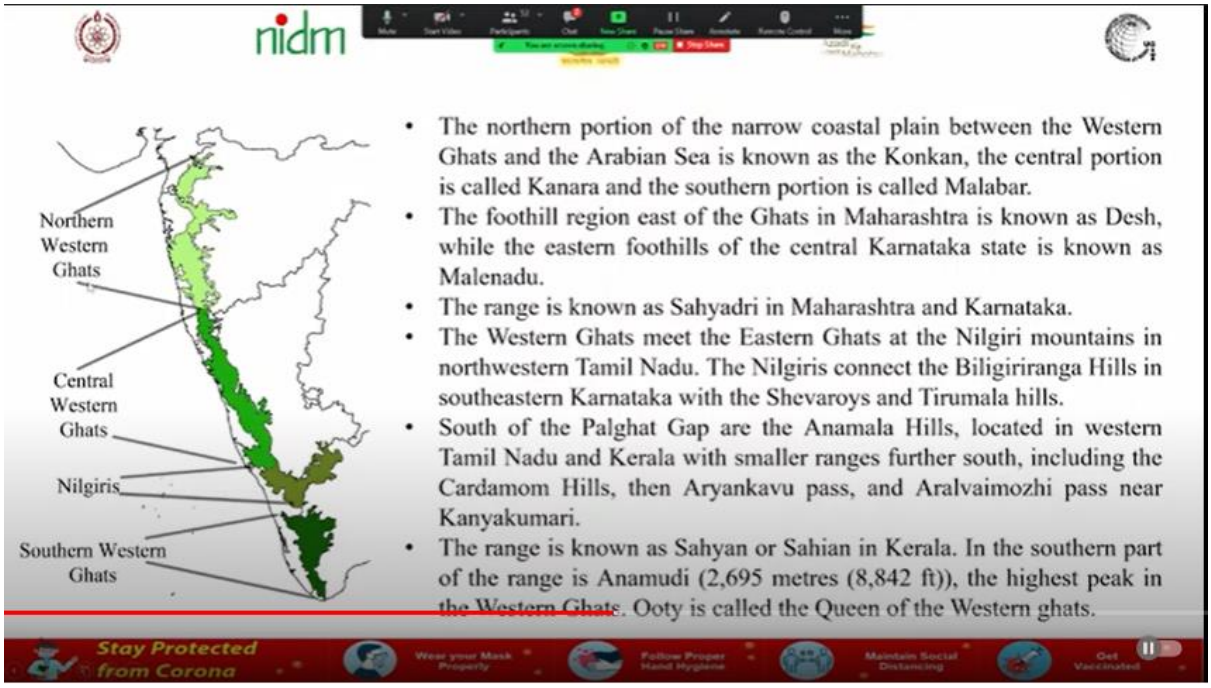
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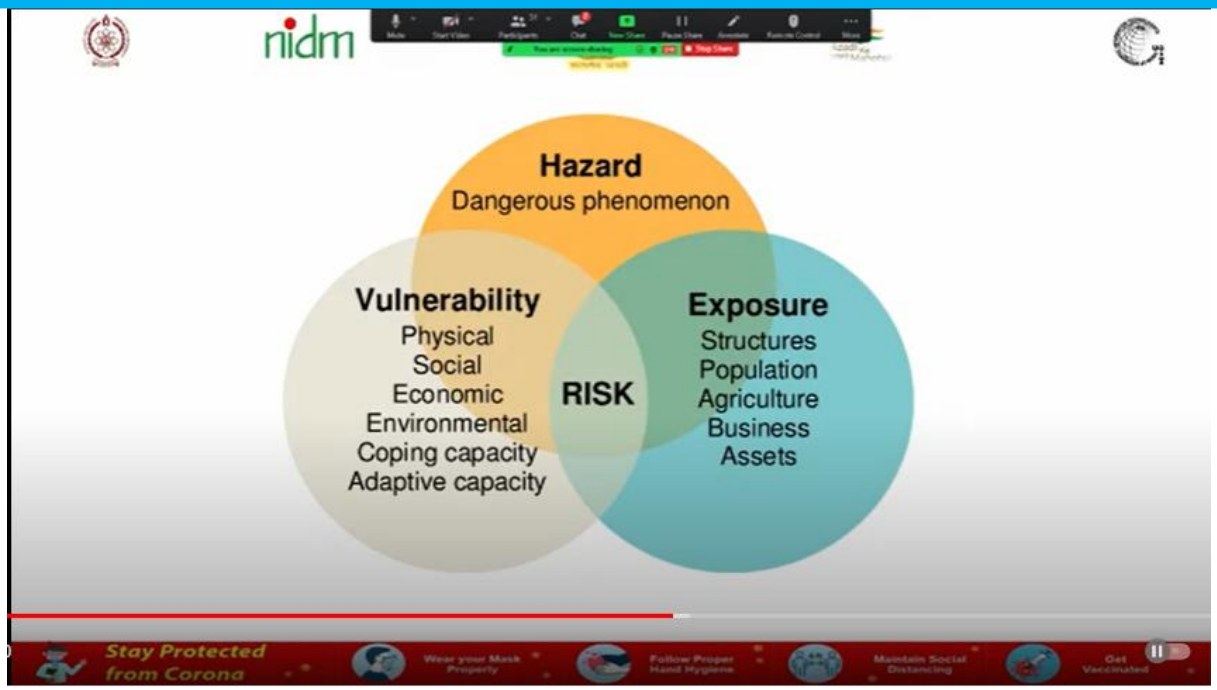
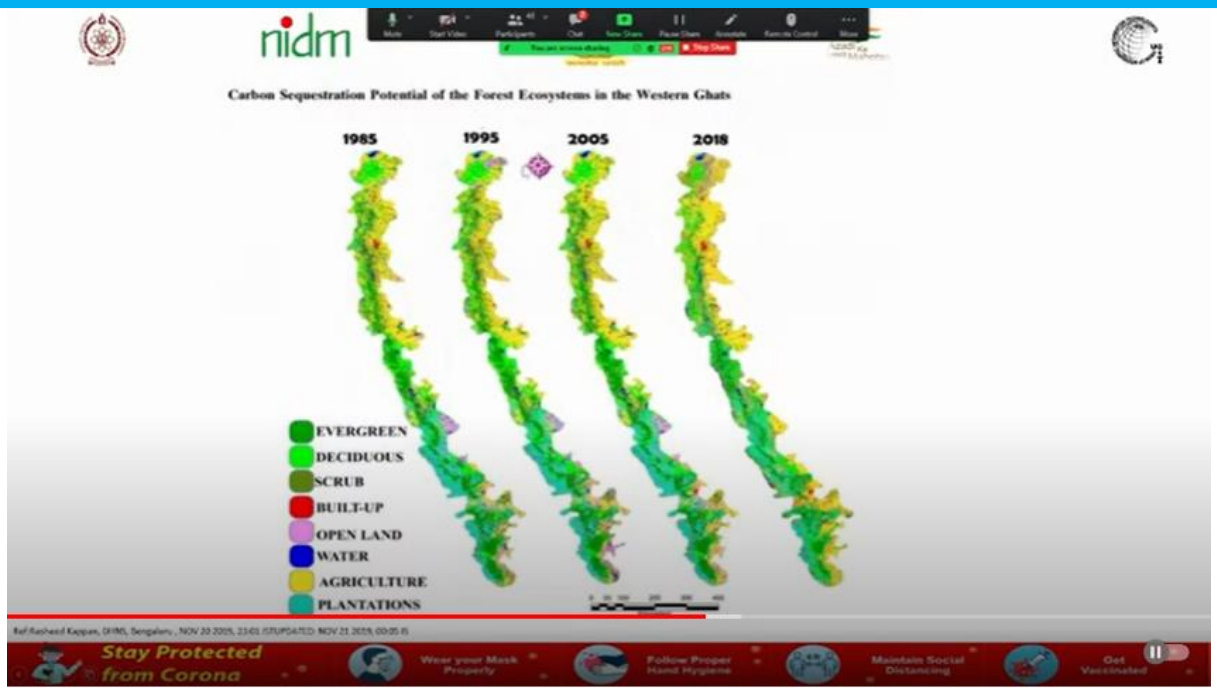
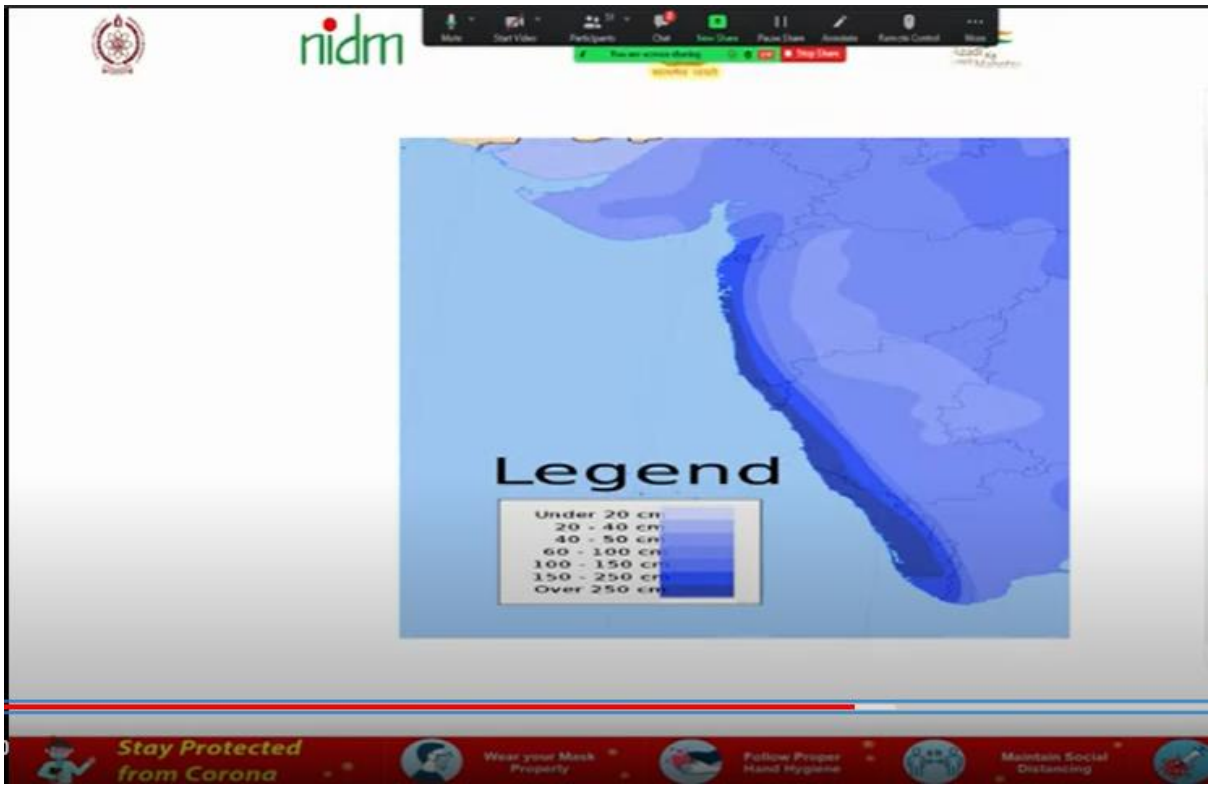
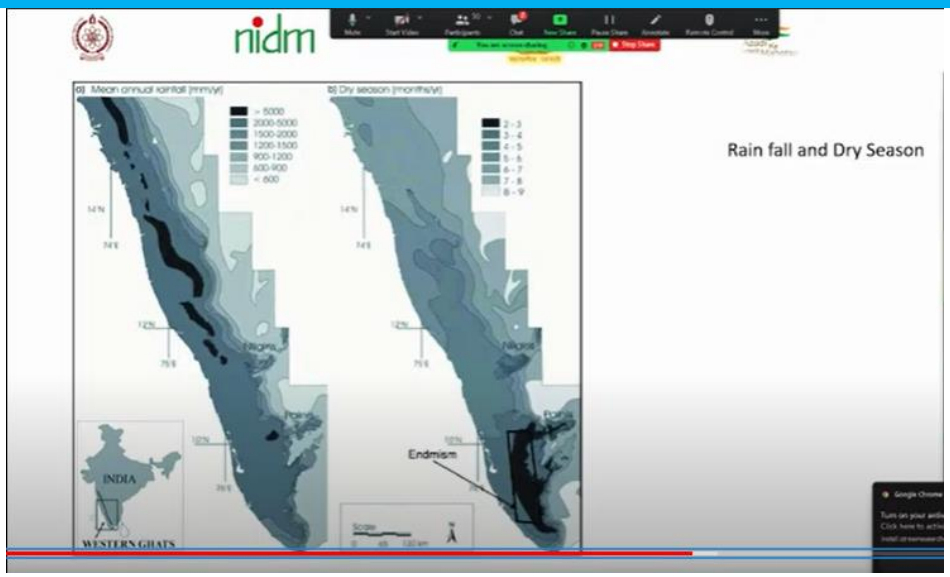
Northern Western Ghats
Central Western Ghats
Nilgiris
Southern Western Ghats
• The northern portion of the narrow coastal plain between the Western Ghats and the Arabian Sea is known as the Konkan, the central portion is called Kanara and the southern portion is called Malabar.
• The foothill region east of the Ghats in Maharashtra is known as Desh, while the eastern foothills of the central Karnataka state is known as Malenadu.
• The range is known as Sahyadri in Maharashtra and Karnataka.
• The Western Ghats meet the Eastern Ghats at the Nilgiri mountains in northwestern Tamil Nadu. The Nilgiris connect the Biligiriranga Hills in southeastern Karnataka with the Shevaroys and Tirumala hills.
• South of the Palghat Gap are the Anamala Hills, located in western Tamil Nadu and Kerala with smaller ranges further south, including the Cardamom Hills, then Aryankavu pass, and Aralvaimozhi pass near Kanyakumari.
• The range is known as Sahyan or Sahian in Kerala. In the southern part of the range is Anamudi (2,695 metres (8,842 ft)), the highest peak in the Western Ghats. Ooty is called the Queen of the Western ghats.
Stay Protected from Corona

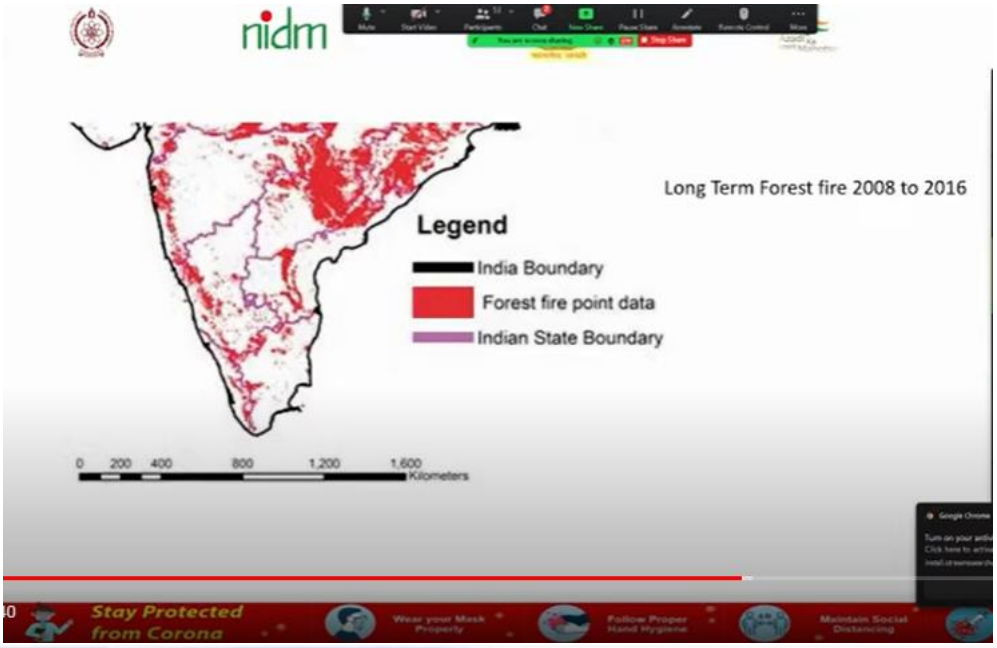

nidm
Hazard
Dangerous phenomenon
Vulnerability
Physical
Social
Economic
Environmental
Coping capacity
Adaptive capacity
RISK
Exposure
Structures
Population
Agriculture
Business
Assets
Stay Protected from Corona


nidm
Susceptibility
×
Vulnerability
=
Risk
Stay Protected from Corona


nidm
Carbon Sequestration Potential of the Forest Ecosystems in the Western Ghats
1985
1995
2005
2018
EVERGREEN
DECIDUOUS
SCRUB
BUILT-UP
OPEN LAND
WATER
AGRICULTURE
PLANTATIONS
Stay Protected from Corona


nidm
Legend
Under 20 cm
20 - 40 cm
40 - 50 cm
60 - 100 cm
100 - 150 cm
150 - 250 cm
Over 250 cm
Stay Protected from Corona


nidm
Rain fall and Dry Season
Endmism
INDIA
WESTERN GHATS


nidm
Long Term Forest fire 2008 to 2016
Legend
India Boundary
Forest fire point data
Indian State Boundary
0 200 400 800 1,200 1,600
Kilometers
Stay Protected from Corona

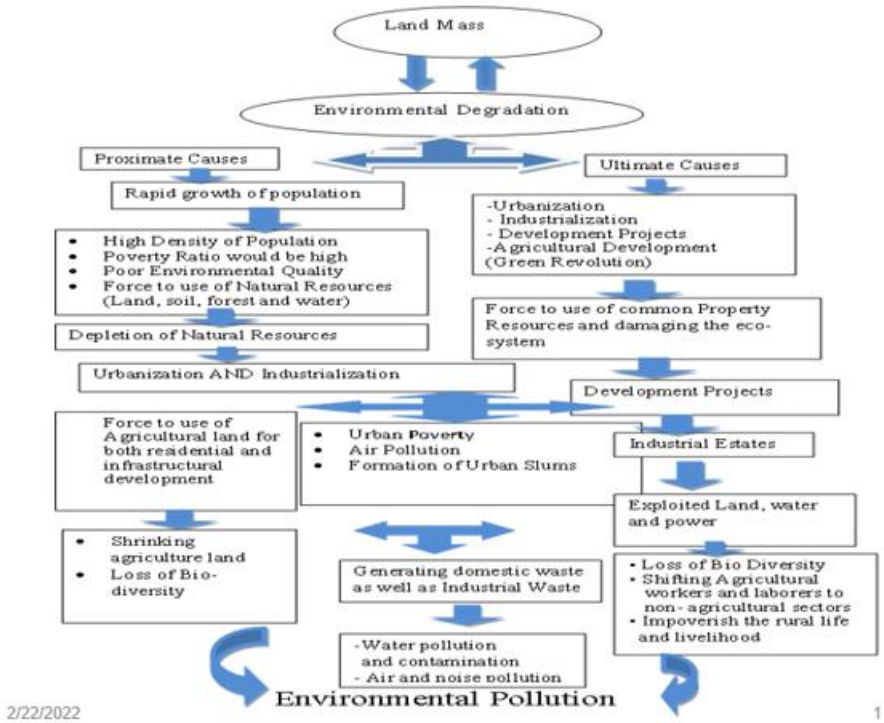

GEO BUIZ
WESTERN GHATS LOST 35.3 PER CENT OF FOREST COVER ACCORDING TO A LATEST FINDING BY NATIONAL REMOTE SENSING CENTRE

Population, development and environment: Regional Issues and Challenges

Ministry of Health & Family Welfare
Government of India

Dr. C.M. Lakshmana
Professor
Population Research Centre (PRC)
Established under the Ministry of Health
& Family Welfare, Government of India,
Institute for Social and Economic Change (ISEC),
Bengaluru-560072

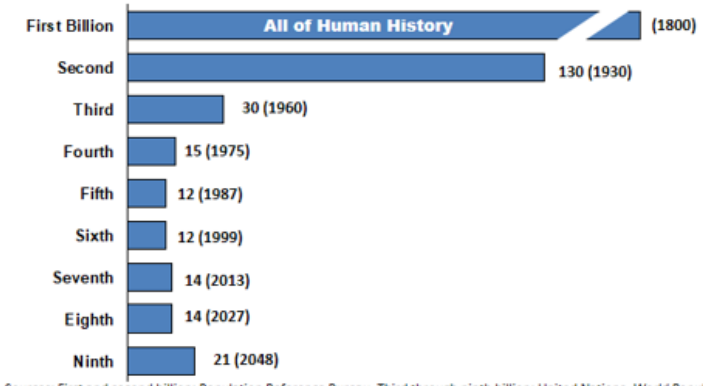
Presented in the 3 Days Training Programme on " Natural Hazards and Anthropogenic Impacts in the Western Ghats" jointly organized by nidm, GoI, Dept of Geography and Union of Geographic Information Technologies , Bangalore University, Bangalore on 23rd Feb, 2022



2/22/2022 1

World Population Growth, in Billions

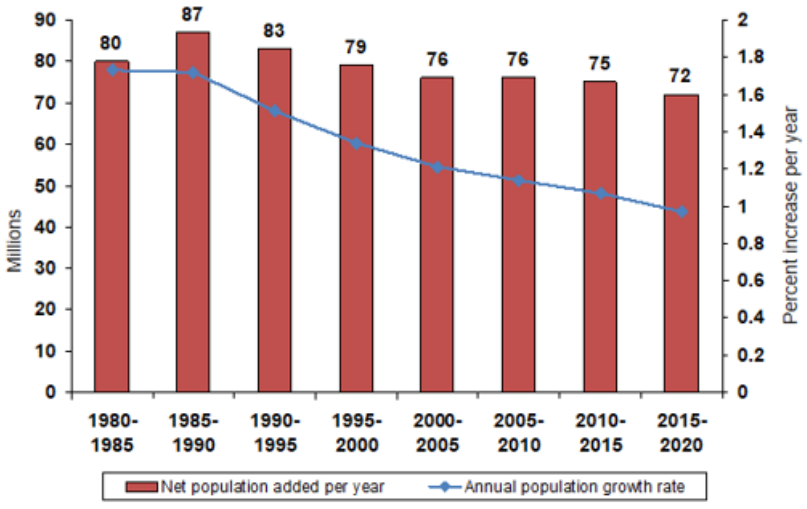
Number of years to add each billion (year)



Sources: First and second billion: Population Reference Bureau. Third through ninth billion: United Nations, *World Population Prospects: The 2004 Revision* (medium scenario), 2005.

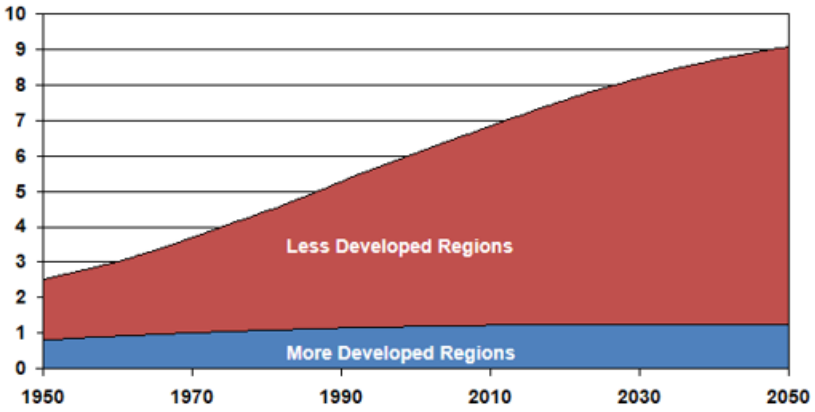
Trends in Population Growth Worldwide

Population Increase and Growth Rate, Five-Year Periods



Source: United Nations, *World Population Prospects: The 2004 Revision* (medium scenario), 2005.

Growth in More, Less Developed Countries



Source: United Nations, *World Population Prospects: The 2004 Revision* (medium scenario), 2005.

The Effects of Urbanization

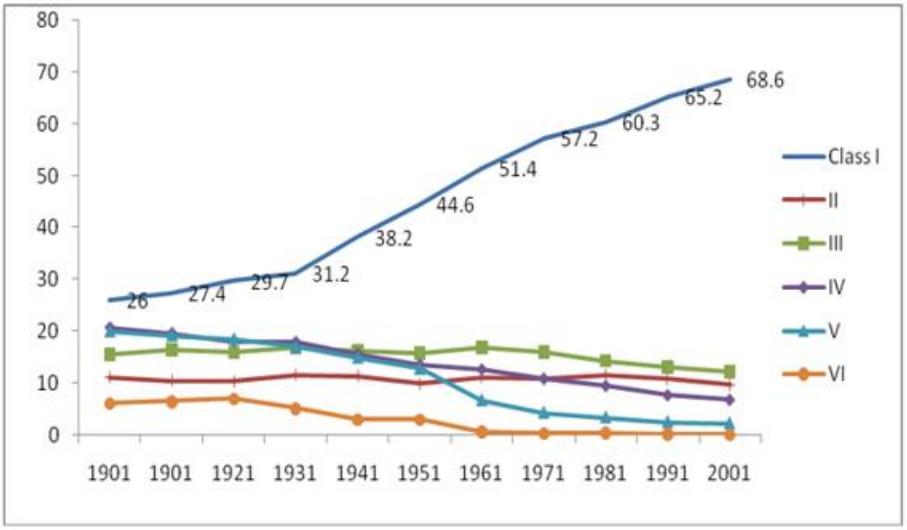


Fig 2: Pace of Urbanization across Towns by class and size in India

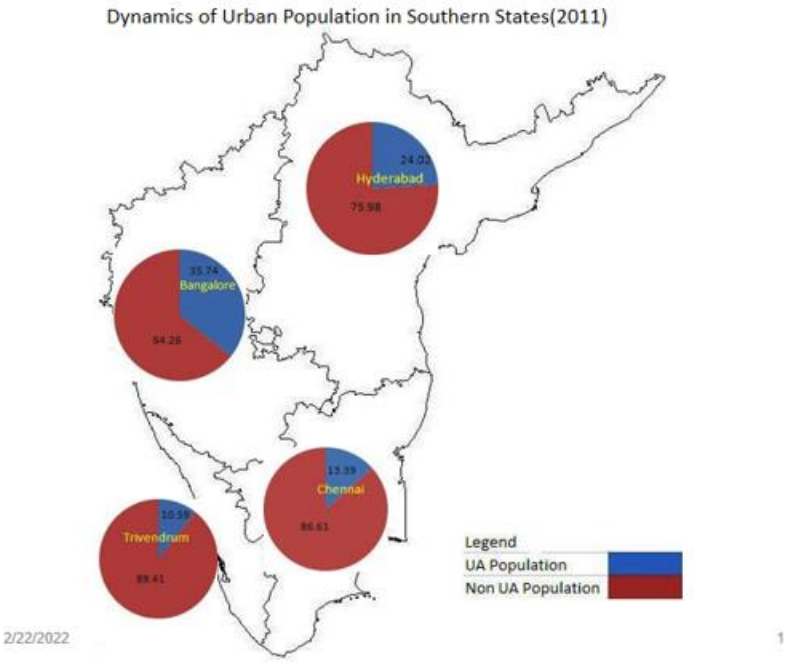
2/22/2022 1

Table 2: Most Populous Cities and their Population by region in India

Region	No.of Cities	Population (in millions) 2001	% age	2011	% age	Proportion of Urban Area to the total Urban Area	Man-Land Ratios per sq.kms
North	28	24.61	17.90	31.65	18.03	14.00	2893
Central	46	27.28	19.85	34.62	19.72	23.00	1926
East	32	16.36	11.90	19.93	11.35	10.14	2516
North-East	3	1.25	0.91	1.56	0.89	3.18	629
West	36	39.91	29.04	55.01	31.33	16.76	4200
South	47	30.22	21.99	35.13	20.01	32.92	1365
India	192	137.45	100.00	175.57	100	100.00	2246

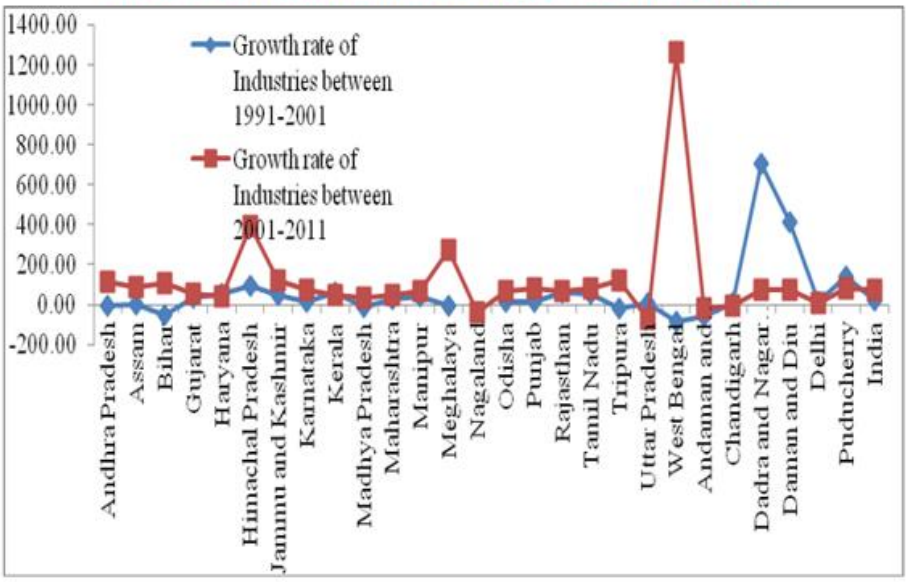
Source: Compliled by the Author used census data

2/22/2022 1



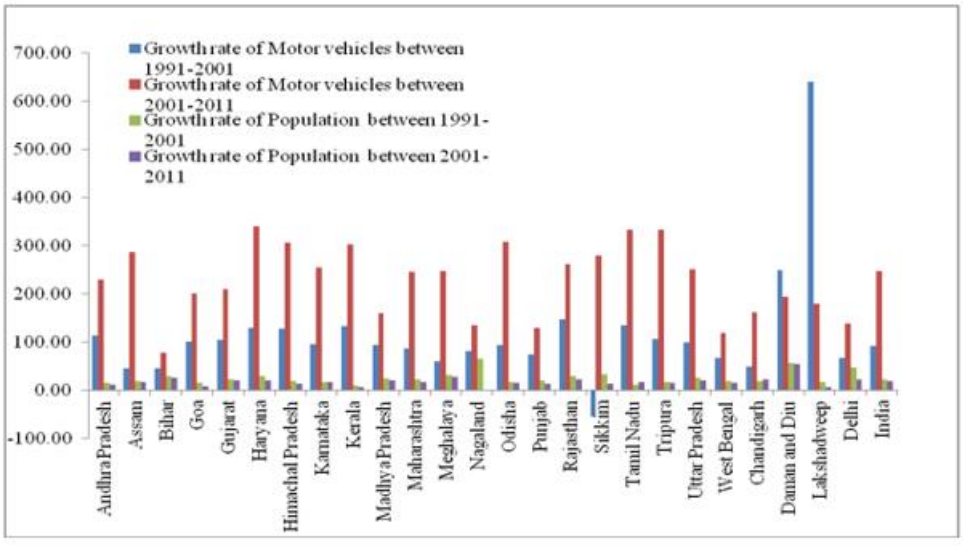
2/22/2022 1

Growth of Industries and its impact on environment



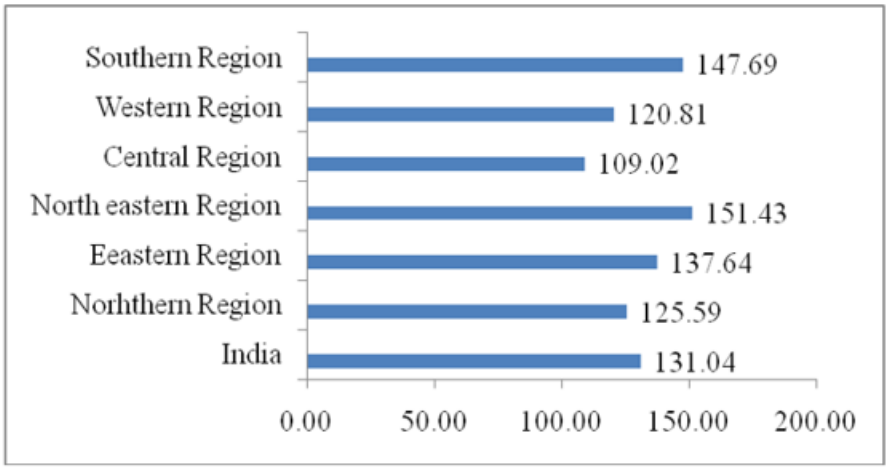
2/22/2022 1

Growth of Registered vehicles and environment



2/22/2022 1

Growth of Two wheelers (between 2001-2011) in India by Region



2/22/2022 1

Development Versus Environmental Degradation:

Table 3. Available Cultivable Land for Agriculture in India by Region

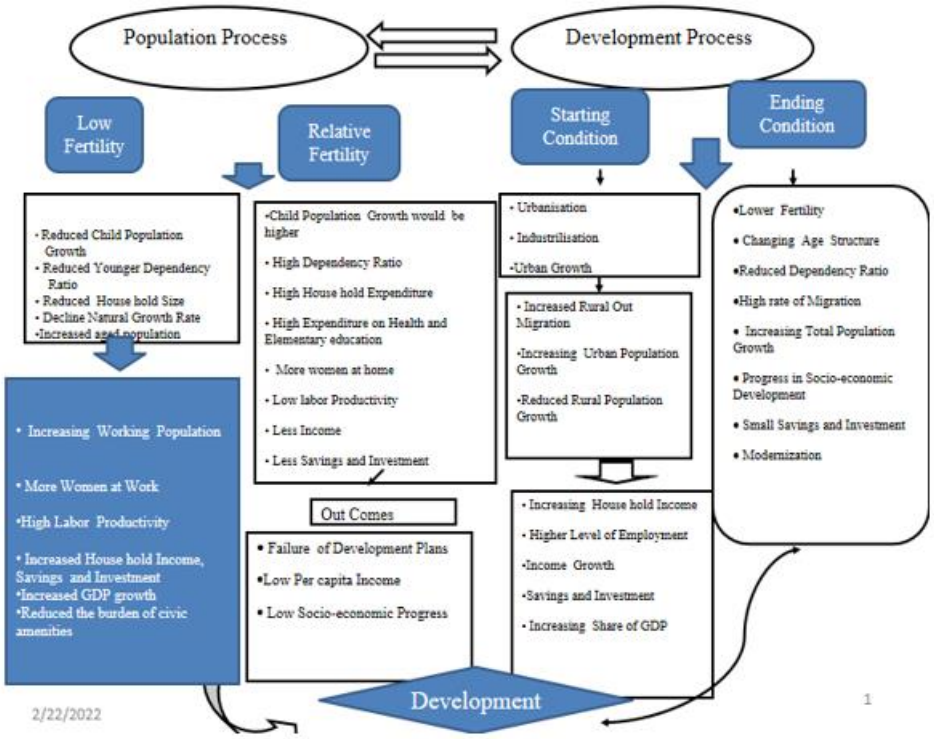
State	Available Land (in hectares)		Shrinking Arable Land (in hectares)	Availability of Land Per-capita	
	1995-1996	2005-2006	1995 to 2005	1995-1996	2005-2006
North	35584	35592	8	0.35	0.27
Central	43581	36644	-6937	0.21	0.13
East	24699	19861	-4838	0.13	0.10
North-East	6255	6167	-88	0.20	0.16
West	33727	33776	49	0.28	0.23
South	39576	39164	-412	0.20	0.18
India	**183626**	**182575**	**-1051**	**0.22**	**0.18**

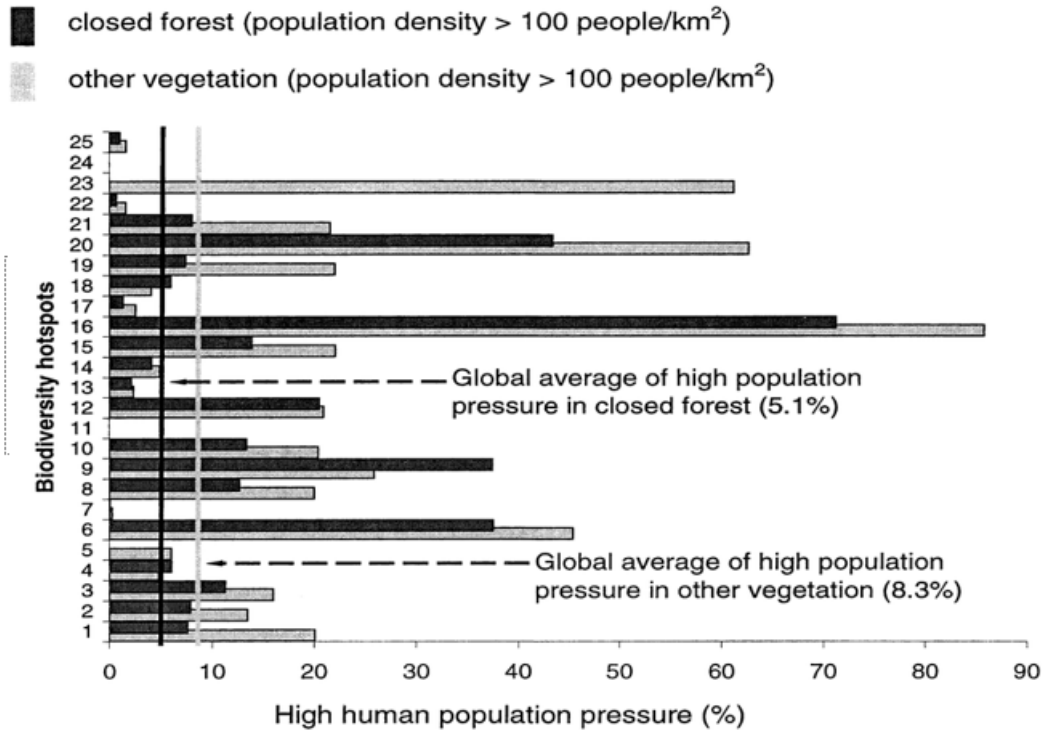
Source: Caluculated by the Author using Census Data

•Increase in population has been directly responsible for the reduction of per capita land availability of a region/country.

• shrinking agriculture land has been extensive in all regions but west and northern regions have exception.
• a huge chunk of arable land is shrinking especially in central and eastern regions. As a result availability of land per capita was low with 0.13 and 0.12 hectares in these regions.
•The west and north regions have gain the arable land instead of shrinking with 49 and 8 hectares respectively. More over land per capita was also as high compared to the other regions in the country.

2/22/2022 1


Population Process
Development Process
Low Fertility
Relative Fertility
Starting Condition
Ending Condition
• Reduced Child Population Growth
• Reduced Younger Dependency Ratio
• Reduced House hold Size
• Decline Natural Growth Rate
•Increased aged population
•Child Population Growth would be higher
• High Dependency Ratio
• High House hold Expenditure
• High Expenditure on Health and Elementary education
• More women at home
• Low labor Productivity
• Less Income
• Less Savings and Investment
• Urbanisation
• Industrilisation
•Urban Growth
• Increased Rural Out Migration
•Increasing Urban Population Growth
•Reduced Rural Population Growth
•Lower Fertility
• Changing Age Structure
•Reduced Dependency Ratio
•High rate of Migration
• Increasing Total Population Growth
• Progress in Socio-economic Development
• Small Savings and Investment
• Modernization
• Increasing Working Population
• More Women at Work
•High Labor Productivity
• Increased House hold Income, Savings and Investment
•Increased GDP growth
•Reduced the burden of civic amenities
Out Comes
• Failure of Development Plans
•Low Per capita Income
• Low Socio-economic Progress
• Increasing House hold Income
• Higher Level of Employment
•Income Growth
•Savings and Investment
• Increasing Share of GDP
Development
2/22/2022
1


closed forest (population density > 100 people/km²)
other vegetation (population density > 100 people/km²)
Biodiversity hotspots
Global average of high population pressure in closed forest (5.1%)
Global average of high population pressure in other vegetation (8.3%)
High human population pressure (%)
0
10
20
30
40
50
60
70
80
90

Western Ghats faces threat to encroachment

- The IUCN World Heritage Outlook 2 report, suggests that climate change will probably exacerbate a system already under pressure and has the potential to impact the large-scale monsoonal processes which the Western Ghats influence.
- 50 million people are estimated to live in the Western Ghats, resulting in biodiversity pressures and loss of forest and wildlife habitats.
- Annual rate of deforestation in Western Ghats was 0.01 from 1995 to 2013 whereas In Western Ghats of Kerala the net rate of deforestation was 0.03 from 1960-1990.
- Forest fragmentation and Increase in urbanization are major components for deterioration of biodiversity in Western Ghats.
- The population in the Western Ghats is increasing with the rate of 2% each and every year that resulting immense anthropogenic pressure in the buffer zone of Western Ghats.

- Western Ghats is highly rich in biological diversity and endemism. At least 325 globally threatened (IUCN Red Data List) species occur in the Western Ghats.
- The main threats impacting biodiversity in the Western Ghats include: Pollution, biological resource use, residential and commercial development, dams and other natural system modifications.
- The impact of climate change has already be observed in north eastern parts of Karnataka, unprecedent rainfall in Western Ghats of Karnataka and Kerala causes flood activities and loss of agriculture/cropland.
- Development project in Western Ghats of Karnataka will have to taken into consideration for the control of long-term climate impact.
- In COP 26, India has already committed to reduce the emission to net zero by restoring forest ecosystem or enhancing protected areas.
- According to a study about 33 per cent of the biodiversity of the Western Ghats will be lost by 2050 due to climate change.

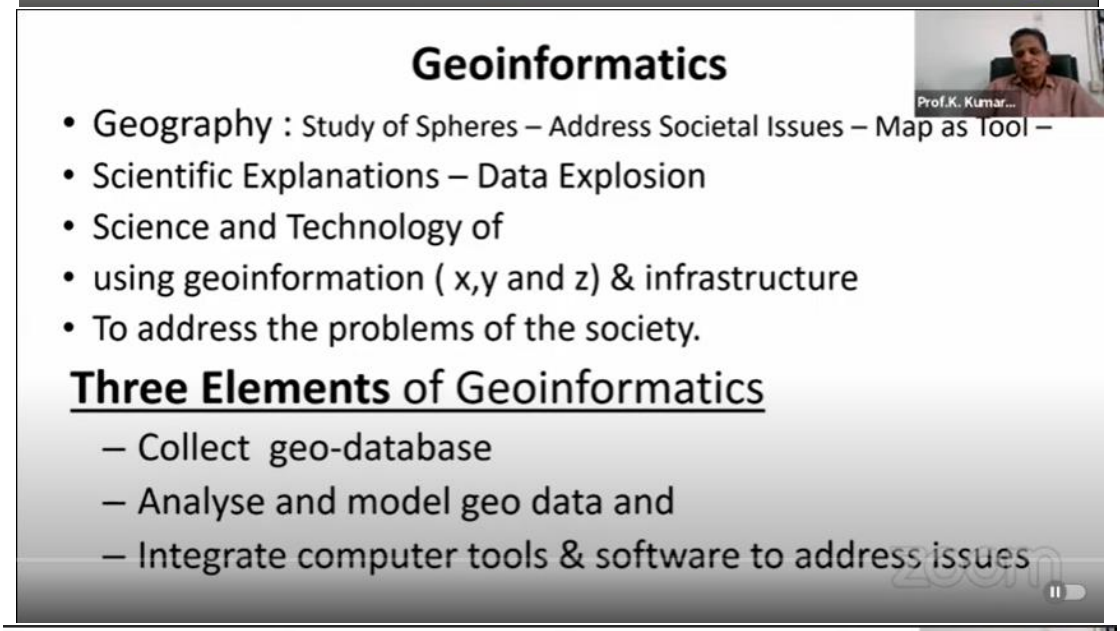
Flood in ecological sensitive zone of Western Ghats of Kerala in 2018

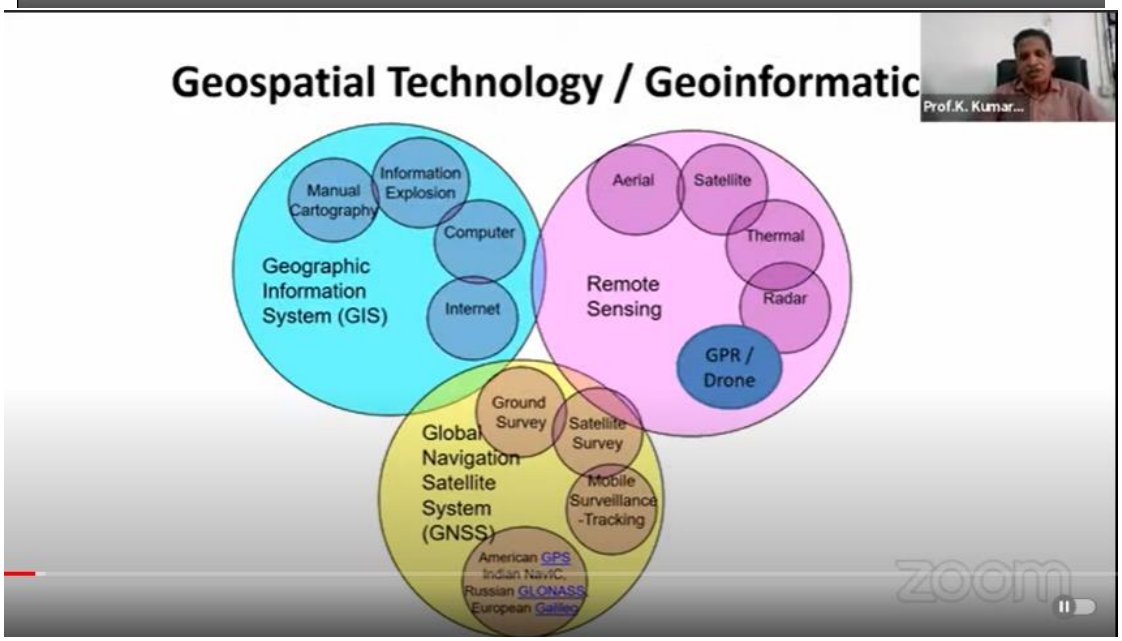
Flood in Chikkamagaluru in 2019

Conclusion

- At the outcome, in India both proximate and ultimate causes have influenced to environmental degradation. And finally it is depend upon the physical characteristics of a region.
- Impact of poverty due to Land degradtion, water and air pollution as influenced by proximate cause quite high in central and east regions.
- Resource degradation and resulted environmental pollution is quite high due to both proximate and ultimate cause in south, north and west regions of India.
- This has drawn much attention, development should go with conserving the natural resources to halt environmental degradation. Sustainable development must go with sustainable environment, which ensure to save our future population on this earth, which further halt to the natural hazards and resulted damage in the country in general western Ghats in particualr.


Geospatial Technology in
Natural Disaster Studies in the Western Ghats of Tamil Nadu
Dr. K. Kumaraswamy
Emeritus Professor – ICSSR Senor Fellow
Department of Geography
Bharathidasan University
Tiruchirappalli – 620 024
E-mail :kkumargeo@gmail.com
Prof.K. Kumar...


Geoinformatics
Prof.K. Kumar...
• Geography : Study of Spheres – Address Societal Issues – Map as Tool –
• Scientific Explanations – Data Explosion
• Science and Technology of
• using geoinformation (x,y and z) & infrastructure
• To address the problems of the society.
Three Elements of Geoinformatics
– Collect geo-database
– Analyse and model geo data and
– Integrate computer tools & software to address issues


Geospatial Technology / Geoinformatic
Prof.K. Kumar...
Manual Cartography
Information Explosion
Computer
Internet
Geographic Information System (GIS)
Aerial
Satellite
Thermal
Radar
GPR / Drone
Remote Sensing
Ground Survey
Satellite Survey
Mobile Surveillance -Tracking
Global Navigation Satellite System (GNSS)
American GPS
Russian GLONASS
European Galileo

Need for Sustainable Development

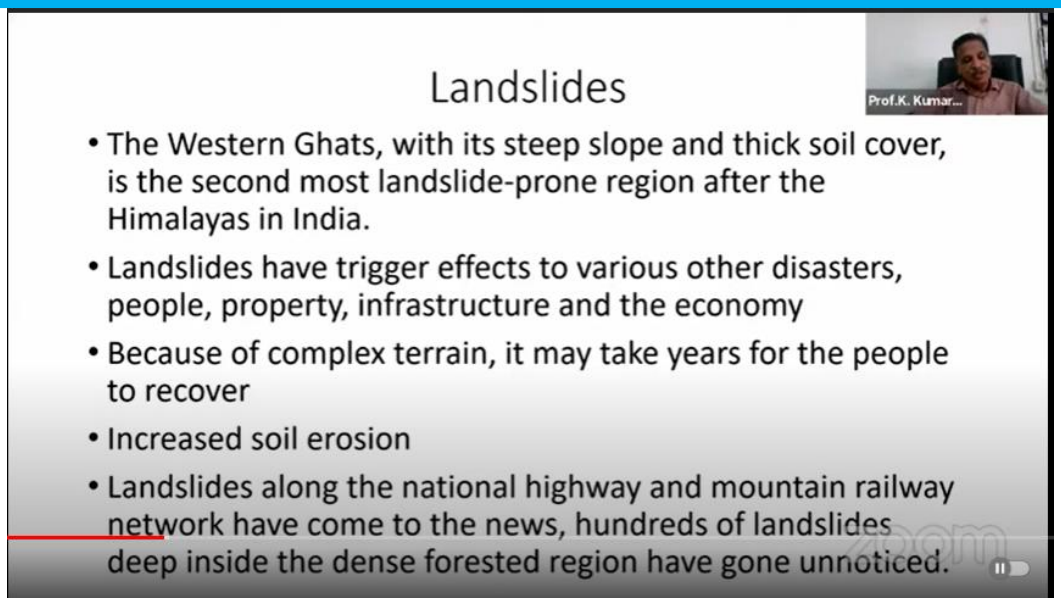
- Solar System is a Dust of the Dust
- Global Resources were Ubiquitous
- Forgotton Judicial Utilisation
- Do not Think of Future Generations
- Wise - Action: Sustainable Development

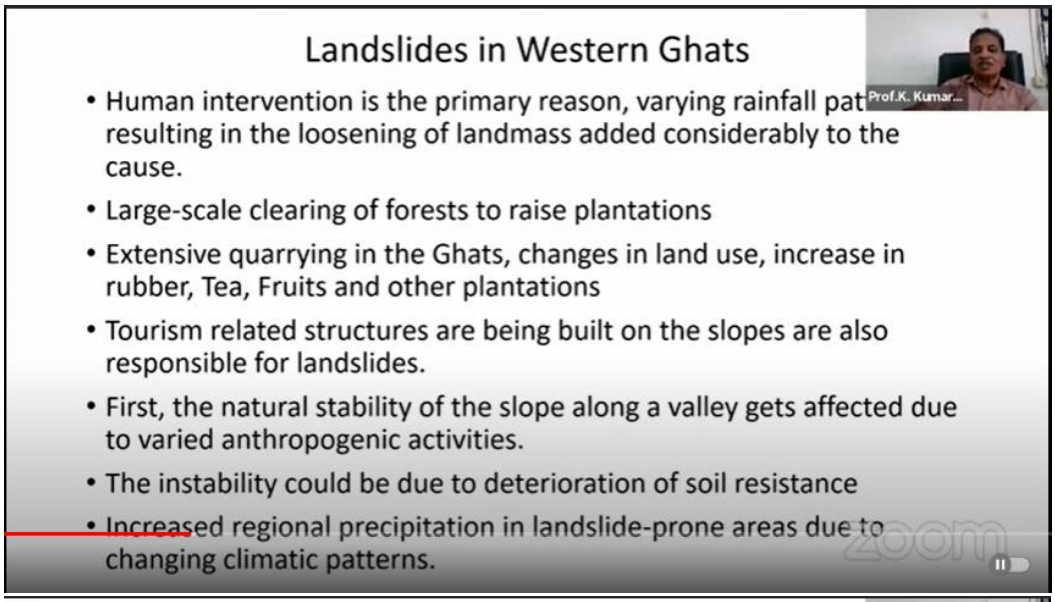
Disasters of the Western Ghats

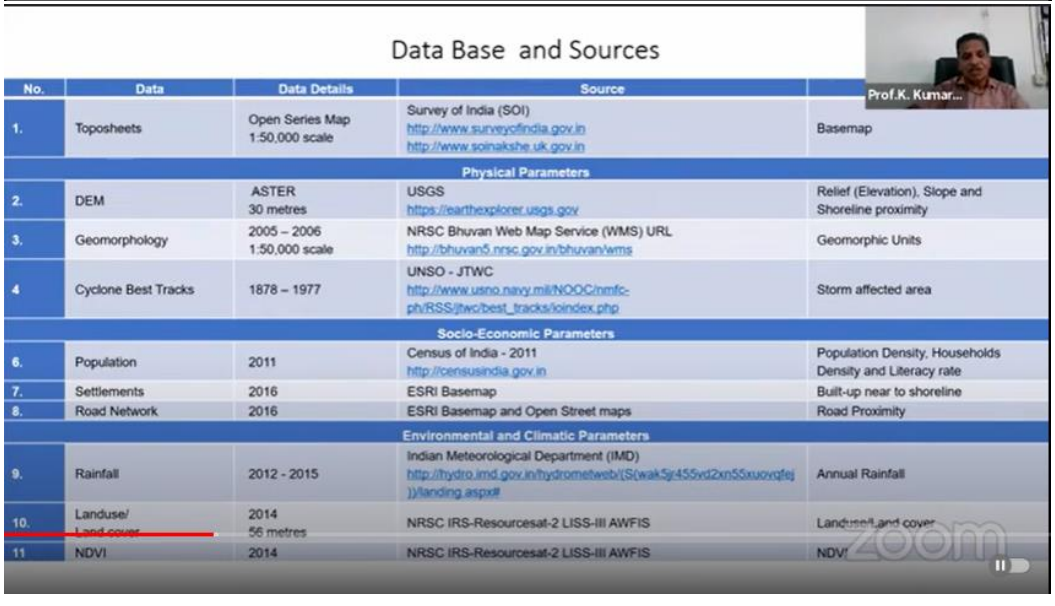
- Landslides and Flooding
- Landuse Changes – Urbanisation – Industries – Plantation and Illegal Cropping
- Forest Fire
- Illegal Mining
- Transport Lines
- Deforestation (?)
- Mountain Tourism
- Encroachment of forest land and poaching of wild life

The Western Ghats

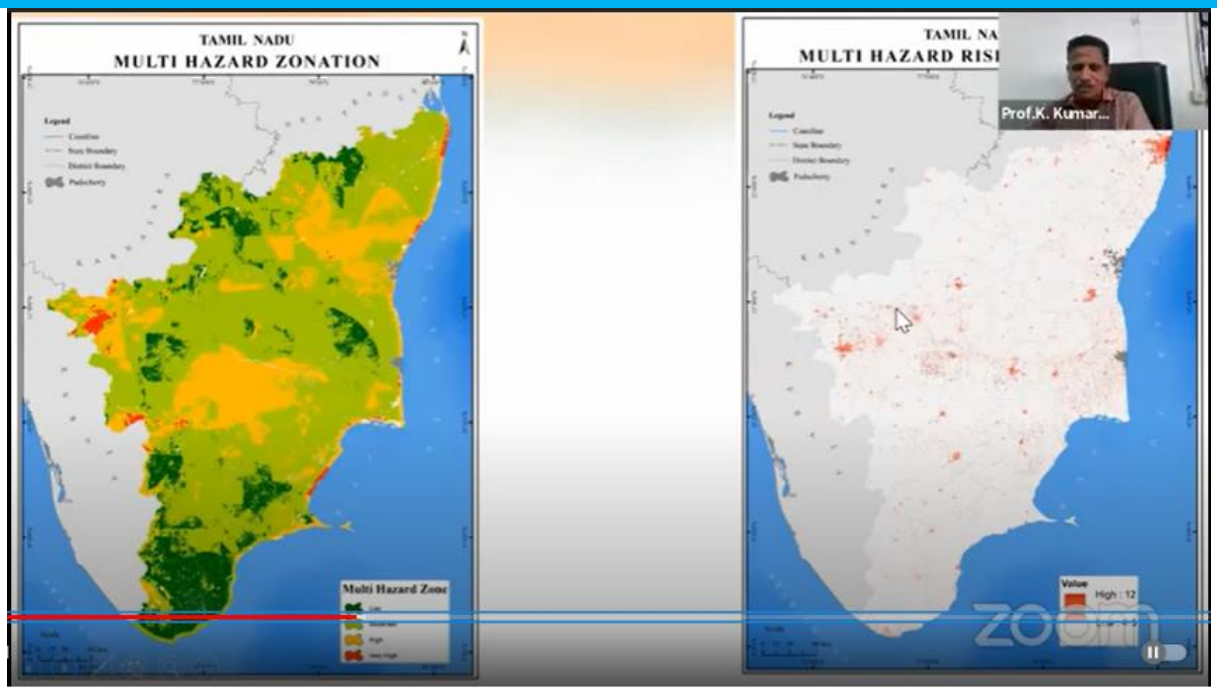
- Dr. M.S. Swaminathan - Hill Areas - Planning Commission.
- Delineation of the areas for coverage by the WGDP - Criteria of elevation (600 metres above MSL) and contiguity with taluka.
- WGDP and HADP in the proportion of 13.39 per cent and 86.61 per cent respectively
- The Programme is implemented in 159 talukas comprising of Western Ghats in five States viz. Maharashtra (62 talukas), Karnataka(40 talukas), Kerala (29 talukas), Tamil Nadu (25 talukas) and Goa (3 talukas) – Revisions – Eco Sensitive Zones.

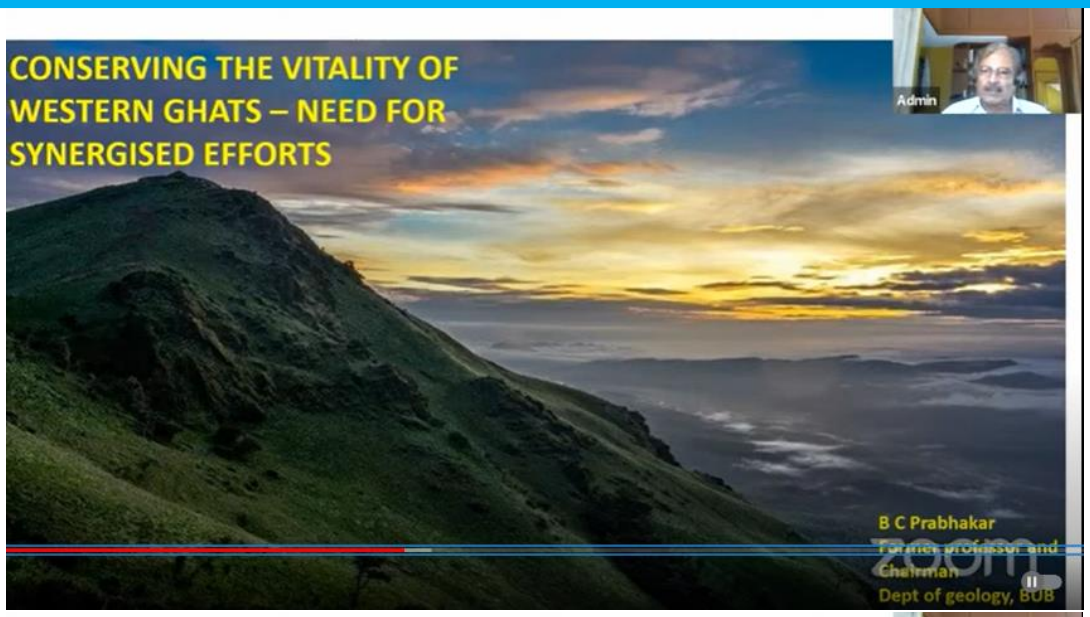




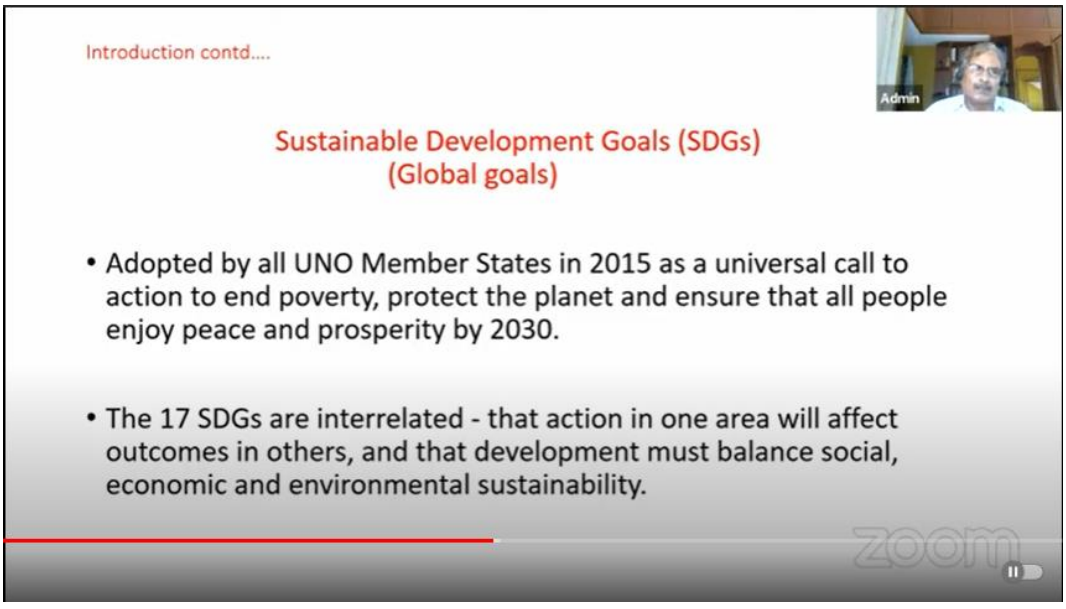


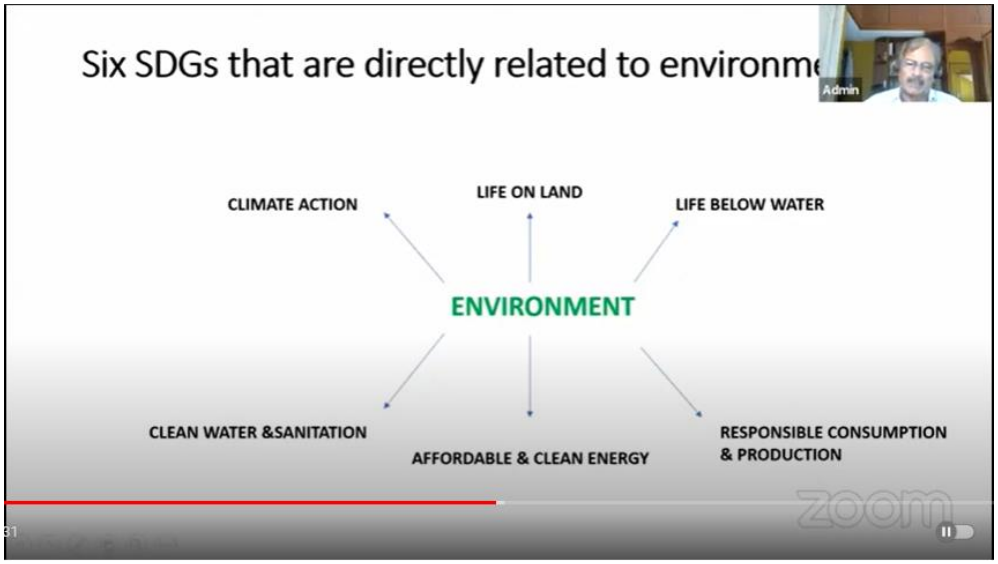
No.	Data	Data Details	Source	
1.	Toposheets	Open Series Map 1:50,000 scale	Survey of India (SOI) http://www.surveyofindia.gov.in http://www.soinakshe.uk.gov.in	Basemap
			Physical Parameters	
2.	DEM	ASTER 30 metres	USGS https://earthexplorer.usgs.gov	Relief (Elevation), Slope and Shoreline proximity
3.	Geomorphology	2005 – 2006 1:50,000 scale	NRSC Bhuvan Web Map Service (WMS) URL http://bhuvan5.nrsc.gov.in/bhuvan/wms	Geomorphic Units
4	Cyclone Best Tracks	1878 – 1977	UNSO - JTWC http://www.usno.navy.mil/NOOC/nmfc-ph/RSS/jtwc/best_tracks/loindex.php	Storm affected area
			Socio-Economic Parameters	
6.	Population	2011	Census of India - 2011 http://censusindia.gov.in	Population Density, Households Density and Literacy rate
7.	Settlements	2016	ESRI Basemap	Built-up near to shoreline
8.	Road Network	2016	ESRI Basemap and Open Street maps	Road Proximity
			Environmental and Climatic Parameters	
9.	Rainfall	2012 - 2015	Indian Meteorological Department (IMD) http://hydro.imd.gov.in/hydrometweb/(S(wak5jr455vd2xn55xuovqfej))/landing.aspx#	Annual Rainfall
10.	Landuse/ Land cover	2014 56 metres	NRSC IRS-Resourcesat-2 LISS-III AWFIS	Landuse/Land cover
11	NDVI	2014	NRSC IRS-Resourcesat-2 LISS-III AWFIS	NDVI

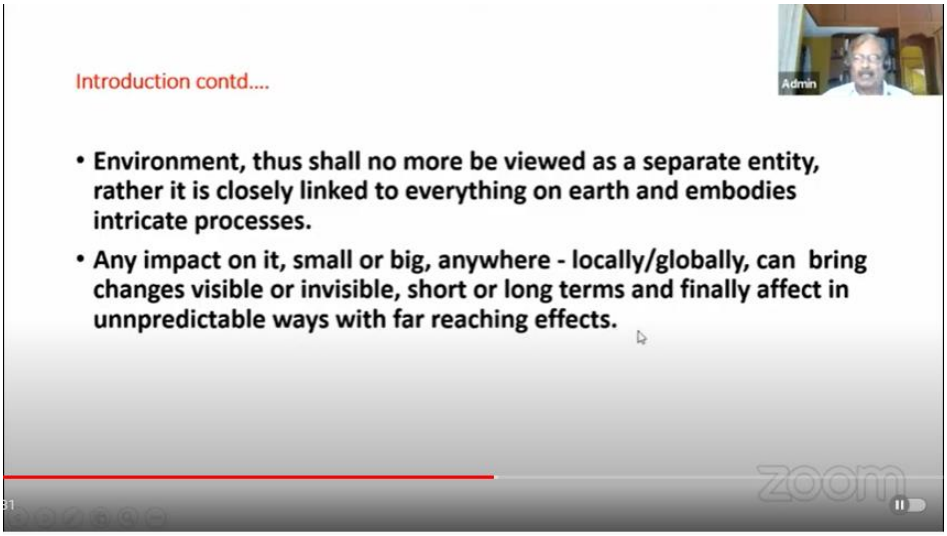

TAMIL NADU
MULTI HAZARD ZONATION
Legend
Multi Hazard Zone
TAMIL NA
MULTI HAZARD RISI
Prof.K. Kumar...
Value
High : 12
zoom

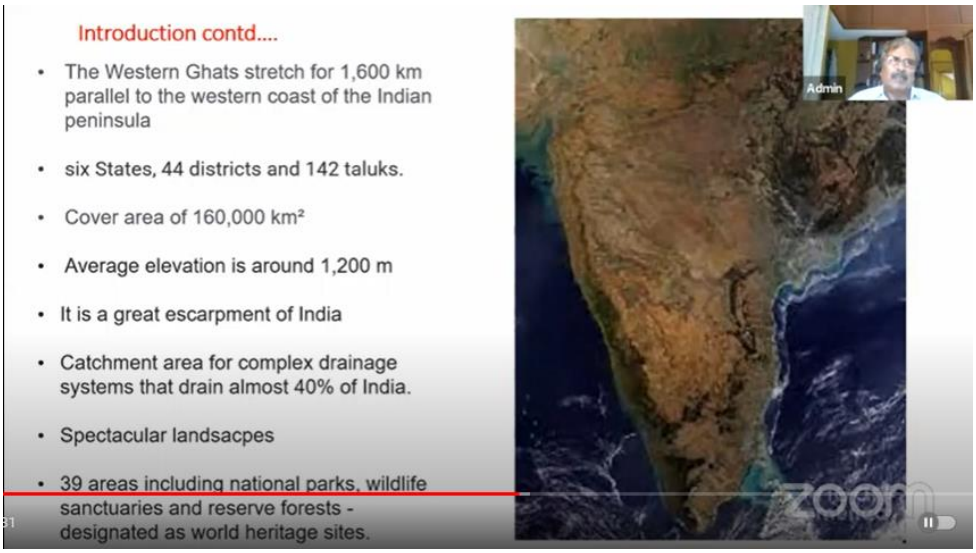

CONSERVING THE VITALITY OF WESTERN GHATS – NEED FOR SYNERGISED EFFORTS
Admin
B C Prabhakar
Dept of geology, BUB
zoom

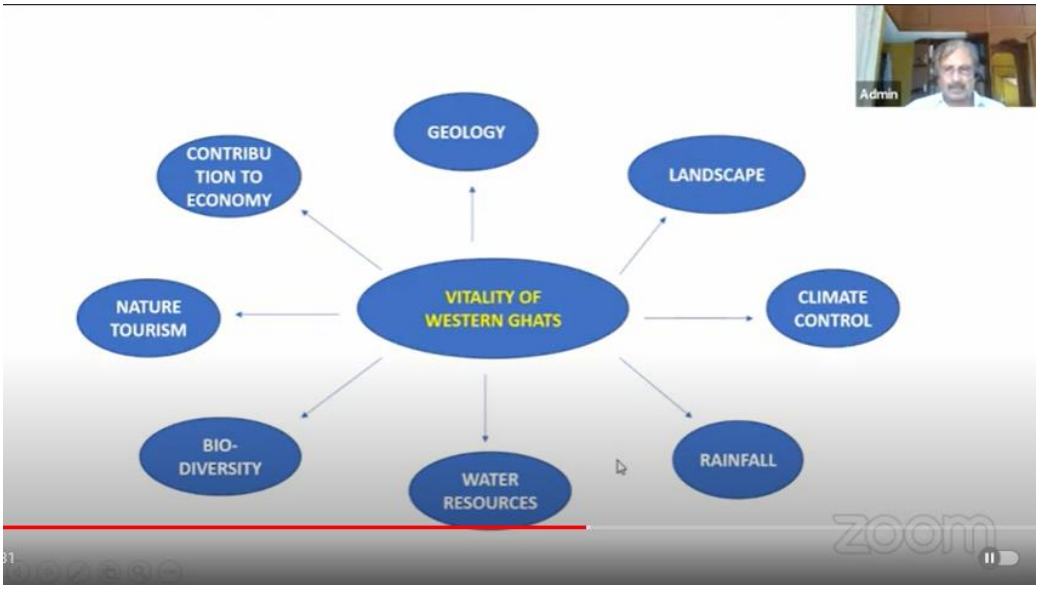

INTRODUCTION
Admin
The present day global challenge
DEVELOPMENT
VS
ENVIRONMENT
Better materialistic comfort to providing basic sustenance
vs
Caring for our natural surroundings.
CHIEF CAUSE: Apathy towards checking global population growth -160 crores in 1900 to 780 crores now; india's 24 crores in 1900 to 138 crores now.
GLOBAL PROJECTION: 960 CRORE BY 2050; INDIA: 165 CRORE.
zoom

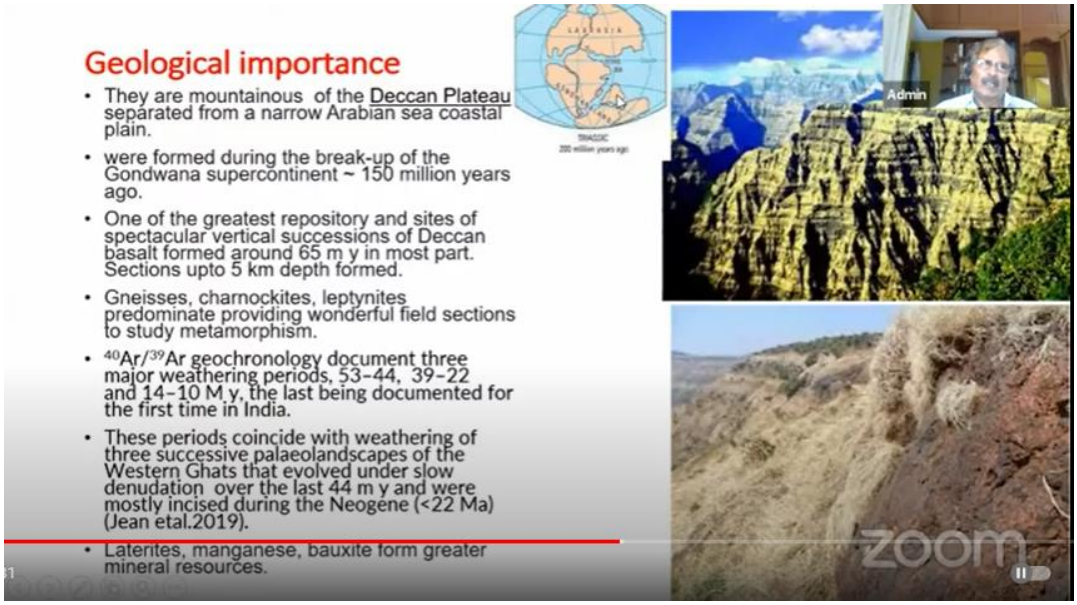

Introduction contd....
Admin
Sustainable Development Goals (SDGs)
(Global goals)
• Adopted by all UNO Member States in 2015 as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030.
• The 17 SDGs are interrelated - that action in one area will affect outcomes in others, and that development must balance social, economic and environmental sustainability.
zoom

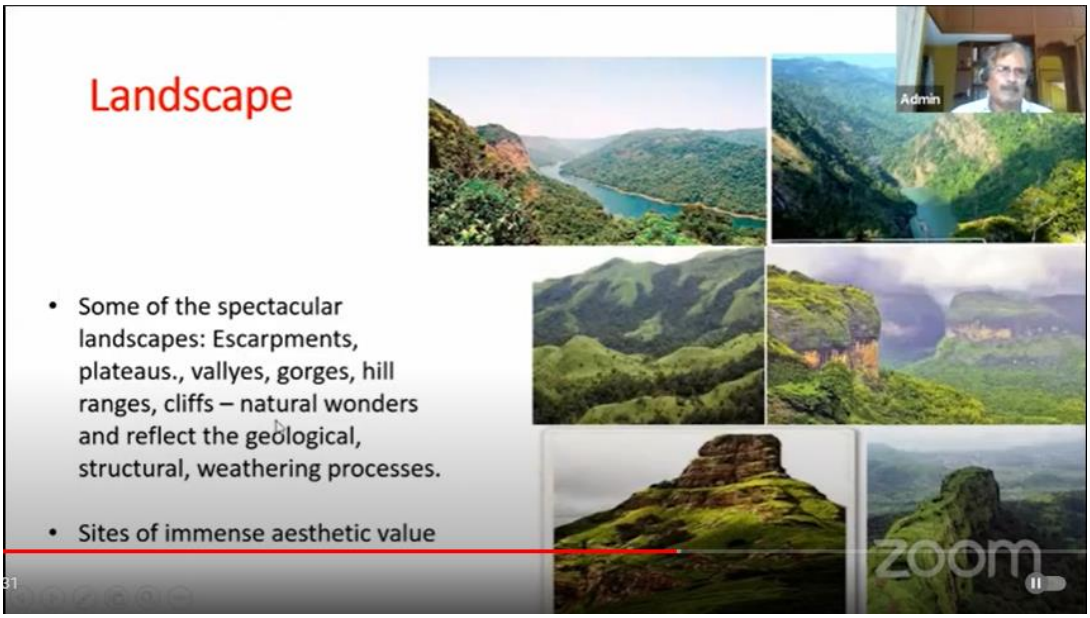

Six SDGs that are directly related to environme
Admin
CLIMATE ACTION
LIFE ON LAND
LIFE BELOW WATER
ENVIRONMENT
CLEAN WATER &SANITATION
AFFORDABLE & CLEAN ENERGY
RESPONSIBLE CONSUMPTION & PRODUCTION
zoom


Introduction contd....
Admin
• Environment, thus shall no more be viewed as a separate entity, rather it is closely linked to everything on earth and embodies intricate processes.
• Any impact on it, small or big, anywhere - locally/globally, can bring changes visible or invisible, short or long terms and finally affect in unnpredictable ways with far reaching effects.
zoom


Introduction contd....
• The Western Ghats stretch for 1,600 km parallel to the western coast of the Indian peninsula
• six States, 44 districts and 142 taluks.
• Cover area of 160,000 km²
• Average elevation is around 1,200 m
• It is a great escarpment of India
• Catchment area for complex drainage systems that drain almost 40% of India.
• Spectacular landsacpes
• 39 areas including national parks, wildlife sanctuaries and reserve forests - designated as world heritage sites.
Admin
zoom

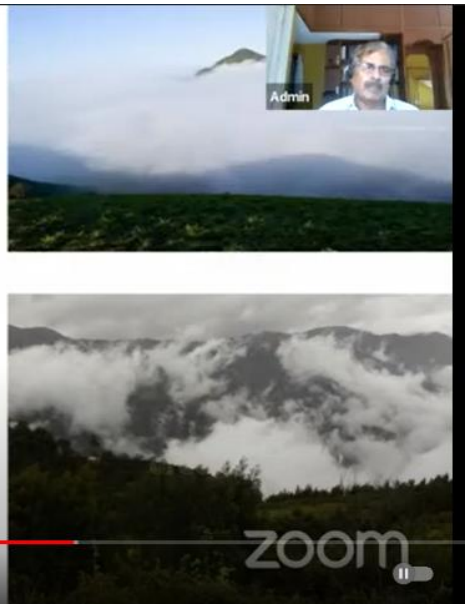

Admin
GEOLOGY
CONTRIBU TION TO ECONOMY
LANDSCAPE
VITALITY OF WESTERN GHATS
NATURE TOURISM
CLIMATE CONTROL
BIO-DIVERSITY
WATER RESOURCES
RAINFALL
zoom


Geological importance
They are mountainous of the Deccan Plateau separated from a narrow Arabian sea coastal plain.
were formed during the break-up of the Gondwana supercontinent ~ 150 million years ago.
One of the greatest repository and sites of spectacular vertical successions of Deccan basalt formed around 65 m y in most part. Sections upto 5 km depth formed.
Gneisses, charnockites, leptynites predominate providing wonderful field sections to study metamorphism.
40Ar/39Ar geochronology document three major weathering periods, 53–44, 39–22 and 14–10 M.y, the last being documented for the first time in India.
These periods coincide with weathering of three successive palaeolandscapes of the Western Ghats that evolved under slow denudation over the last 44 m y and were mostly incised during the Neogene (<22 Ma) (Jean etal.2019).
Laterites, manganese, bauxite form greater mineral resources.
Admin
zoom


Landscape
Some of the spectacular landscapes: Escarpments, plateaus., vallyes, gorges, hill ranges, cliffs – natural wonders and reflect the geological, structural, weathering processes.
Sites of immense aesthetic value
Admin
zoom

Climate control

- They influence Indian monsoon weather patterns by intercepting the rain-laden monsoon winds that sweep in from the south-west.
- The climate is humid and tropical in the lower reaches tempered by the proximity to the sea.
- Elevations of 1,500 m and above in the north and 2,000 m and above in the south have a more temperate climate.
- The average annual temperature is around 15 °C .
- In some parts frost is common, and temperatures reach the freezing point during the winter months.
- Mean temperatures range from 20 °C in the south to 24 °C in the north.
- coldest periods in the South Western Ghats coincide with the wettest.
- Cool the southern plains of peninsula through their moist laiden air



Water resources

- The Western Ghats act as a huge reservoir supplying water to six states
- Major watersheds of India, feeding the perennial rivers - Godavari, Kaveri, Krishna, Thamiraparani and Tungabhadra rivers.
- The majority of streams draining the Western Ghats join these rivers, and carry a large volume of water during the monsoon months.
- Major tributaries include the Bhadra, Bhavani, Bhima, Malaprabha, Ghataprabha, Hemavathi and Kabini rivers, Periyar, Pamba, Netravati, Sharavathi, Kali, Mandovi and Zuari rivers
- Accounts for about 255 BCM of surface water through its rivers and accounts for 16% of country's river water source.

Biodiversity

- It is a UNESCO World Heritage Site and is one of the eight biodiversity hotspots in the world – evergreen to semidecidous forest cover
- large proportion of the country's flora and fauna, many of which are endemic to these region.
- 7,402 species of flowering plants,
  1,814 species of non-flowering plants,
  139 mammal species,
  508 bird species,
  227 reptile species,
  179 amphibian species,
  290 freshwater fish species, and
  6,000 insect species.
- It is likely that many undiscovered species live in the Western Ghats.
- At least 325 globally threatened species occur in the Western Ghats.
- The area covers five percent of India's land; 27% of all species of higher plants in India (4,000 of 15,000 species) are found here and 1,800 of these are endemic to the region

Biodiversity contd....

- In 2006, India applied to the UNESCO Man and the Biosphere Programme (MAB) for the Western Ghats to be listed as a protected World Heritage Site
- It's a fragile ecosystem; sustain biosphere, nutrient cycle, biogeochemical cycles, hydrologic cycle, atmospheric cleansing etc.
- Fragile ecosystems are extremely imp for human sustenance – productivity, revenue generation, employment potential and health

Nature tourism

- One of the emerging industries in India and it can significantly contribute to local economy and ecology conservation and western ghats are on the top of the lists.
- The Government of India has established many protected areas - 2 biosphere reserves - 13 national parks, several wildlife sanctuaries, reserve forests,
- The Nilgiri Biosphere Reserve, Nagarahole, Bandipur ,Wayanad-Mukurthi ,Mudumalai National Park-Sathyamangalam , Silent Valley etc.

Contribution to economy

- Wetsern ghats occupy 5% of the geographic area
- The rivers have been dammed for hydroelectric and irrigation purposes with major reservoirs spread across the states.
- The Western Ghats account for 80% of India's hydropower generation.
- The reservoirs are important for their commercial and sport
- There are about 50 major dams along the length of the Western Ghats – Koyna, Linganmakki and krishna Raja Sagara , Mettur, Pykara ,Parambikulam, Malam puzha and Idukki .

Contribution to economy contd.....

- Benefits 'over 250 million people' in the peninsula – accounts for about 0.5 lakh crore USD to GDP of country.
- Valuation of forest goods and services benefit 2-10 lakh per hectare per year provisioning, regulation, cultural and supporting services.
- If they are not valued, degrading practices overwhelm
- Benefits of conservation– regulation of microclimate, regional energy budgets, improvement in air quality, remediation of contaminants, green cover in the catchment preventing soil erosion,arresting siltation, mitigation of floods, landslides, carbon sequestering,

Human induced hazards on western ghat

HAZARDS AND DISASTERS

Hazard - source or a situation with the potential for harm – damage

Disaster – A disaster is a serious disruption, occurring over a relatively short time-widespread human, material, economic or environmental loss -exceeds the ability of the affected community or society to cope using its own resources.

Human induced hazards

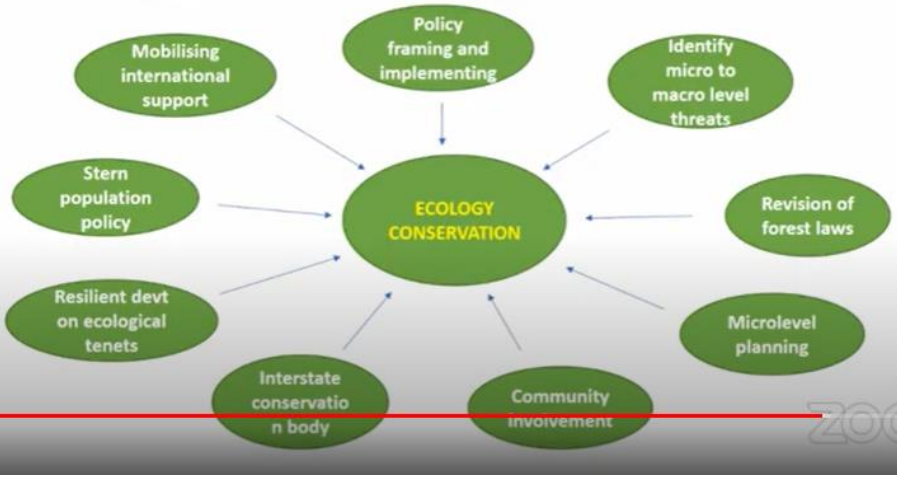
- The Western Ghats face a lot of threats - Deforestation, mining, Poaching, encroachment etc
- The rich biodiversity in both flora and fauna have made the Western Ghats a target for many corporate companies to gain resources.
- Animals that eat livestock are also being killed by farmers.
- Forest fires especially in the Nagarhole-Bandipur-Wayanad-Mudumalai-Satyamangalam-BRT block which has the most biodiverse locations in the Western Ghats with the largest populations of tigers and elephants residing there – are some times triggered by humans.

Human induced hazards and consequences

- Ill-advised decisions costing dearly
- It has ecological sensitivity – responds to impact on environment.
- Found that perennial streams when vegetation cover of >55% and seasonal <35%.
- loss of 36% forest cover in Kerala and 24% in Coorg in the last 5 decades.
- Flooding, erosion, landslides loss of life and property and threatening lively hood.

Synergising the conservation efforts

The debate between development and environment is unendin
there is a dire need to strike the balance:



Policy framing and implementing:

- **Ministry of Environment and Forests of India** set up in March 2010 an expert panel –**Madhav Gadgil** commission - to find a strategy for conserving these Ghats - as **Western Ghats Ecology Expert Panel (WGEEP)**.
- The commission submitted the report to the Government of India on 31 August 2011.

Criticisms of Gadgil Report

- it was more environment-friendly and not in tune with the ground realities.
- were cited as impractical to implement.
- complete eco-sensitive cover for the Western Ghats which hamper different states on energy and development fronts.
- criticism against the constitution of a new body called WGEA. States insist that protection can be given under existing laws.
- against dams in the Western Ghats, which is a crucial blow on the ailing power sector.
- *And the most important: The Gadgil Committee report adversely affects the various mafia . When made public, there were a lot of protests against it from the sand mining and quarrying lobbies in Goa. Many mafias created fear among farmers in Kerala that the Gadgil report is against them, and that they will lose livelihood if its recommendations are implemented.*

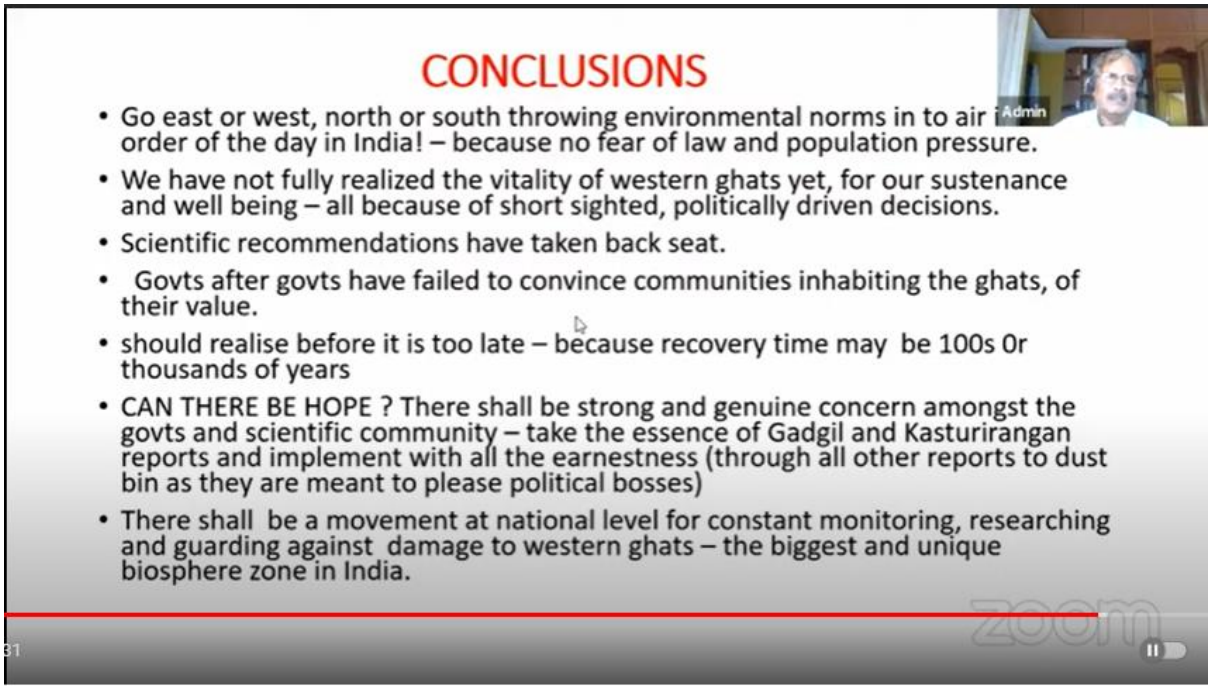
Another committee

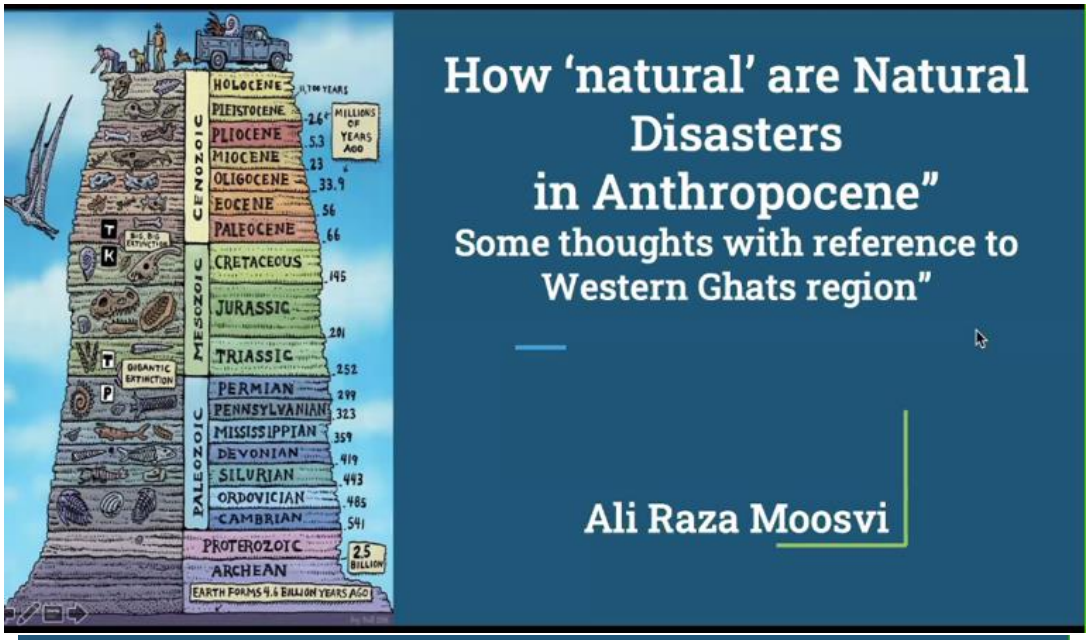
Another committee to study Kasturi Rangan report!

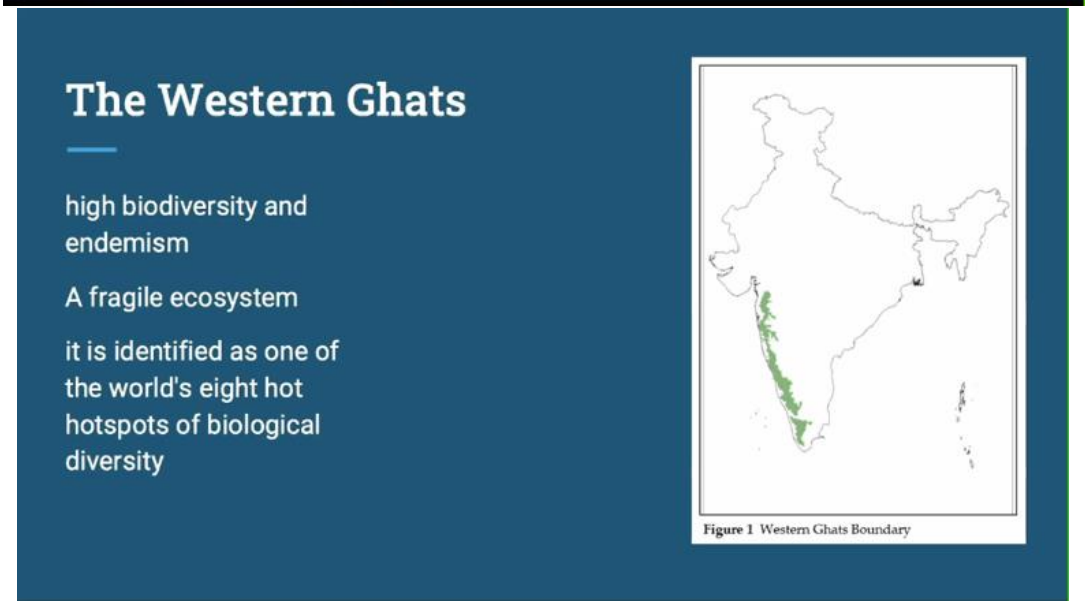
- **Oommen V Oommen Committee** : As people turned violent and started protests, Oommen Chandy, the then Chief Minister of Kerala set up an expert committee ,
- The expert committee, appointed by the Kerala government, to study the Kasturirangan report in detail submitted its report to chief minister CM.

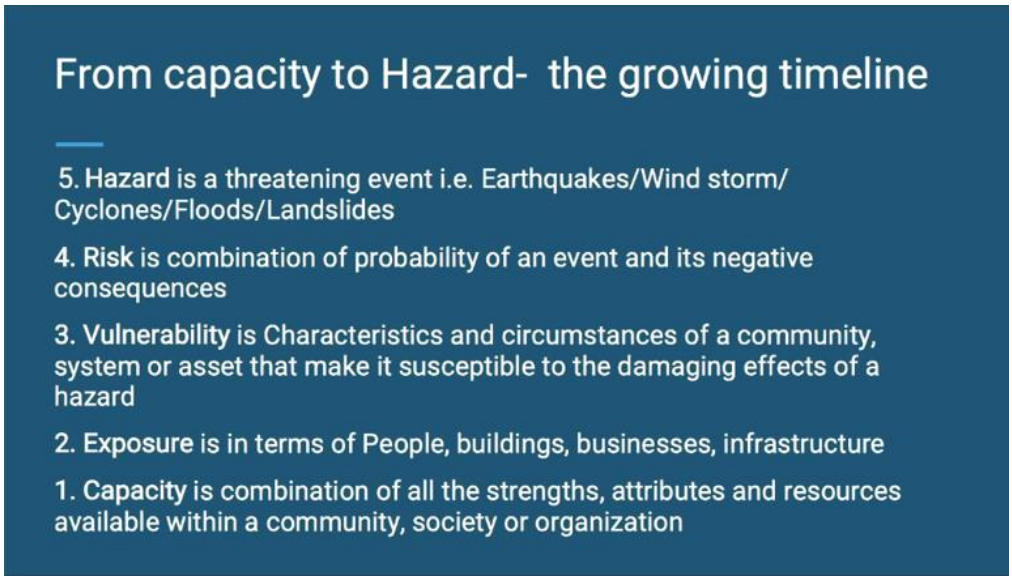
Why people turned violent?

- Farmers were worried of Gadgil report, fearing their eviction.
- They fear the same of Kasturirangan report too.
- It means no report can satisfy all, at least in this country!
- Though there are many who treat Kasturirangan report as a more practical report, the truth is that Gadgil report was not anti-farmer.
- Also, people had misconceptions about Ecologically Fragile Lands (EFL) and Ecologically Sensitive Areas (ESA). Both of them were different concepts under different laws–the first under forest department and the latter under the district administration and pollution control board.
- protests often are not due to love towards the environment, but often because of fear of eviction or loss of livelihood.
- Centre issued an office order in November 2013 directing immediate implementation of five proposals in the Kasturirangan report.
- This was the immediate provocation for the agitation. Later, the central government sought the opinion of the five states in implementing the report. Dialogues were still on and the government had asked the state governments to submit their views on the report.

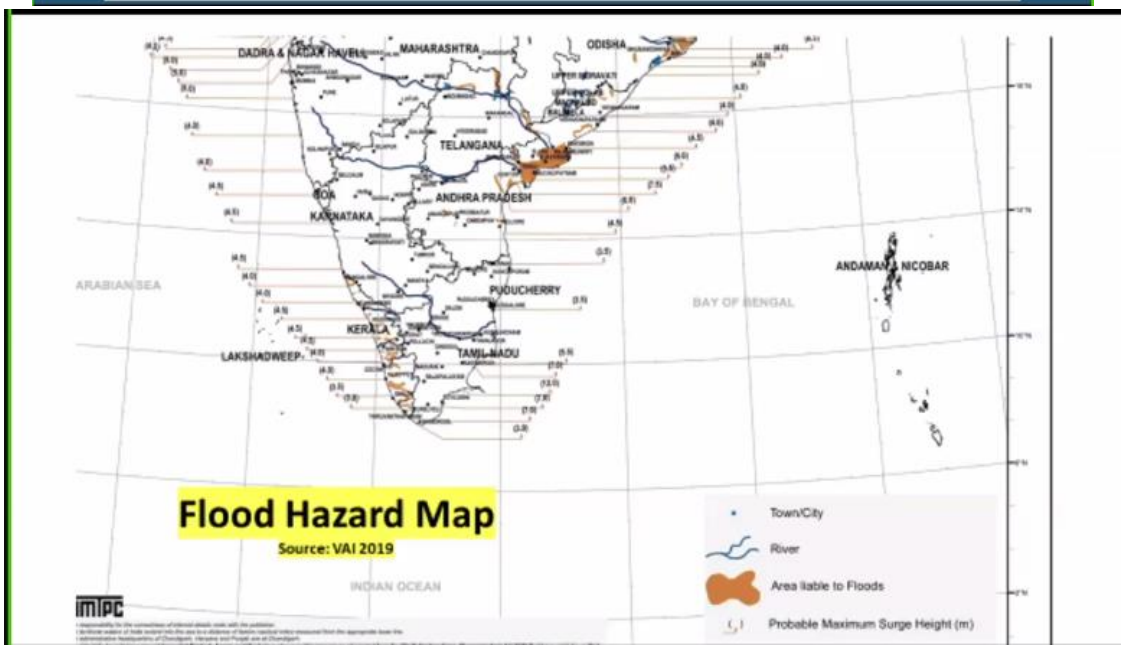

CONCLUSIONS
Admin
• Go east or west, north or south throwing environmental norms in to air i
order of the day in India! – because no fear of law and population pressure.
• We have not fully realized the vitality of western ghats yet, for our sustenance and well being – all because of short sighted, politically driven decisions.
• Scientific recommendations have taken back seat.
• Govts after govts have failed to convince communities inhabiting the ghats, of their value.
• should realise before it is too late – because recovery time may be 100s 0r thousands of years
• CAN THERE BE HOPE ? There shall be strong and genuine concern amongst the govts and scientific community – take the essence of Gadgil and Kasturirangan reports and implement with all the earnestness (through all other reports to dust bin as they are meant to please political bosses)
• There shall be a movement at national level for constant monitoring, researching and guarding against damage to western ghats – the biggest and unique biosphere zone in India.
zoom


How 'natural' are Natural Disasters in Anthropocene"
Some thoughts with reference to Western Ghats region"
Ali Raza Moosvi
HOLOCENE
PLEISTOCENE
PLIOCENE
MIOCENE
OLIGOCENE
EOCENE
PALEOCENE
CRETACEOUS
JURASSIC
TRIASSIC
PERMIAN
PENNSYLVANIAN
MISSISSIPPIAN
DEVONIAN
SILURIAN
ORDOVICIAN
CAMBRIAN
PROTEROZOIC
ARCHEAN
CENOZOIC
MESOZOIC
PALEOZOIC
MILLIONS OF YEARS AGO
25 BILLION
EARTH FORMS 4.6 BILLION YEARS AGO

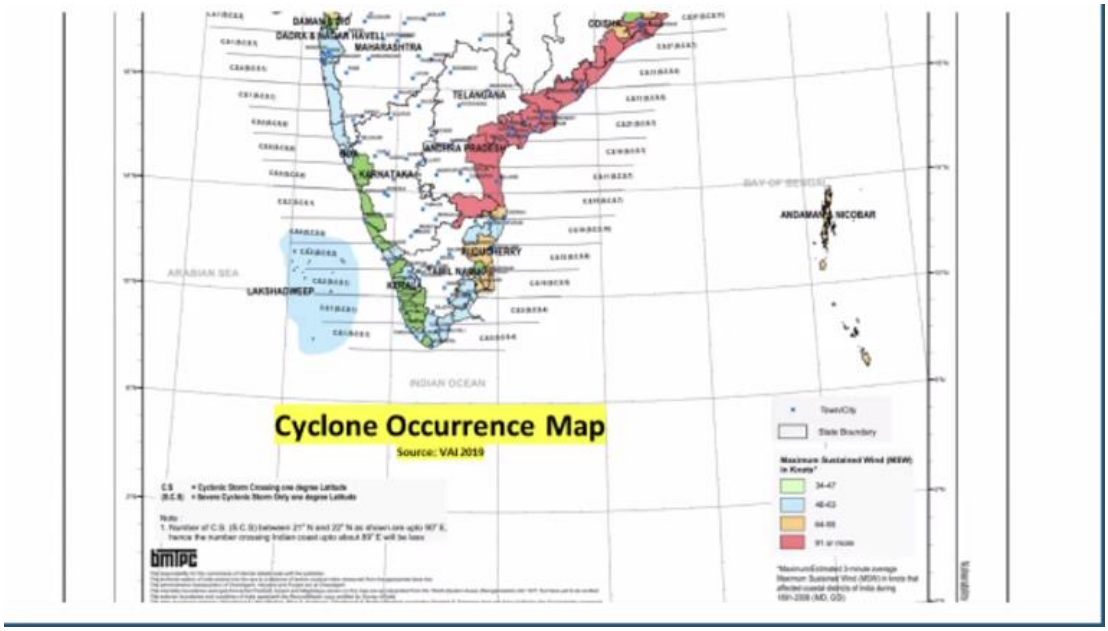

The Western Ghats
high biodiversity and endemism
A fragile ecosystem
it is identified as one of the world's eight hot hotspots of biological diversity
Figure 1 Western Ghats Boundary


From capacity to Hazard- the growing timeline
5. Hazard is a threatening event i.e. Earthquakes/Wind storm/ Cyclones/Floods/Landslides
4. Risk is combination of probability of an event and its negative consequences
3. Vulnerability is Characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard
2. Exposure is in terms of People, buildings, businesses, infrastructure
1. Capacity is combination of all the strengths, attributes and resources available within a community, society or organization

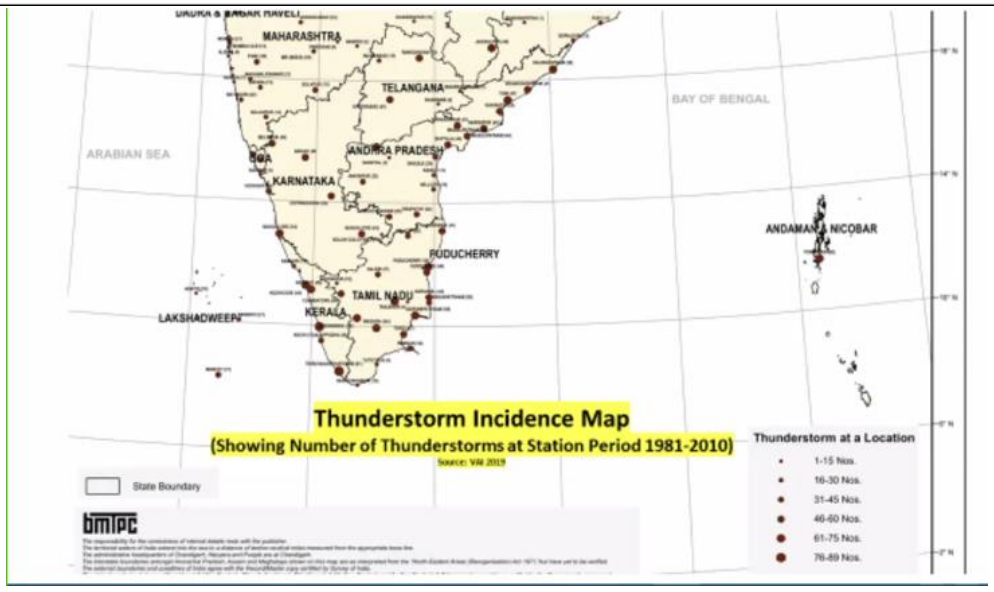

Vulnerability Atlas of India 2019 GoI
DAMAN & DIU
DADRA & NAGAR HAVELI
MAHARASHTRA
ODISHA
TELANGANA
ANDHRA PRADESH
GOA
KARNATAKA
ARABIAN SEA
BAY OF BENGAL
ANDAMAN & NICOBAR
PUDUCHERRY
TAMIL NADU
KERALA
LAKSHADWEEP
INDIAN OCEAN
Town/City
Landslide
State Boundary
Annual Rainfall Normals (mm)
250 - 500
501 - 1000
1001 - 2000
2001 - 3000
> 3000
Landslide Incidence Map (with Annual State Rainfall Normals)
Source: VAI 2019

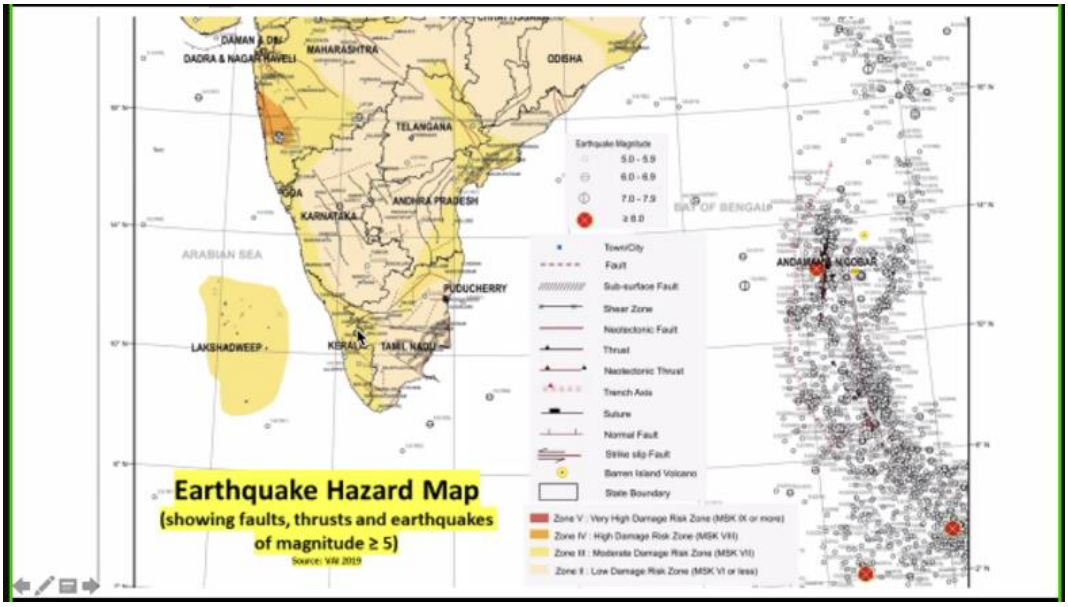

DADRA & NAGAR HAVELI
MAHARASHTRA
ODISHA
TELANGANA
GOA
ANDHRA PRADESH
KARNATAKA
ARABIAN SEA
BAY OF BENGAL
ANDAMAN & NICOBAR
PUDUCHERRY
KERALA
LAKSHADWEEP
TAMIL NADU
INDIAN OCEAN
Flood Hazard Map
Source: VAI 2019
Town/City
River
Area liable to Floods
Probable Maximum Surge Height (m)
IMPC

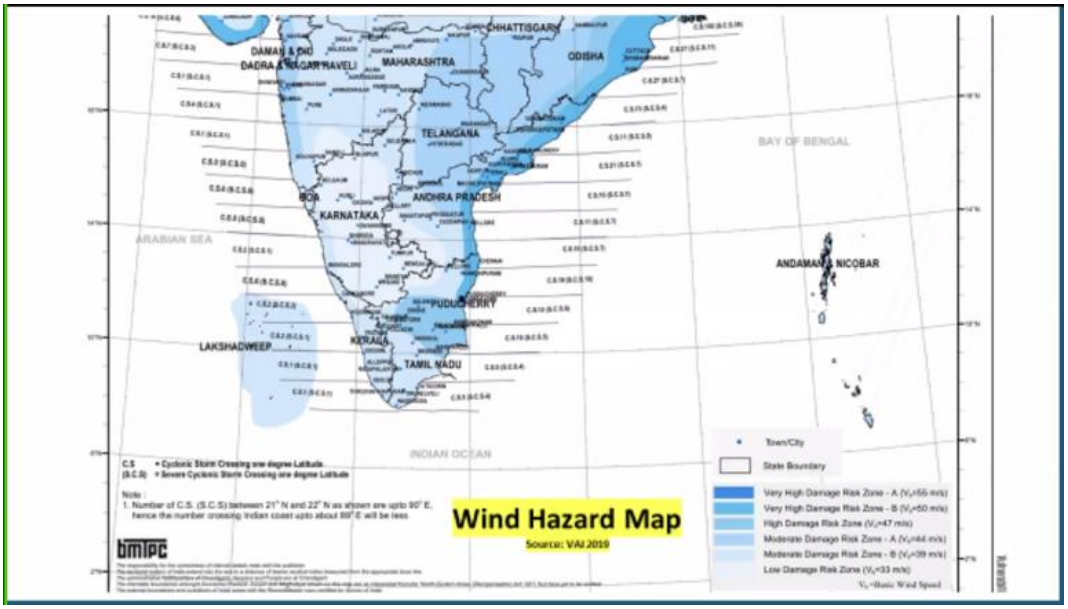

Kerala Floods - A result of poor dam management
An aerial view of flood-hit areas of Aluva in Kochi



Cyclone Tauktae (May 2021) and Ockhi (Dec 2017)







How 'natural' are these hazards

- Are they the result of normal geomorphic or geological agents?
- Are they the result of a natural timeline and time cycle?
- Is it the classical concept of the Malthusian theory at work?
- Vindication of the Gandhian concept that there is enough for everyone's need but not greed?

Understanding 'Anthropocene', the recent age of man.

An idea built on a 'human-centred' world

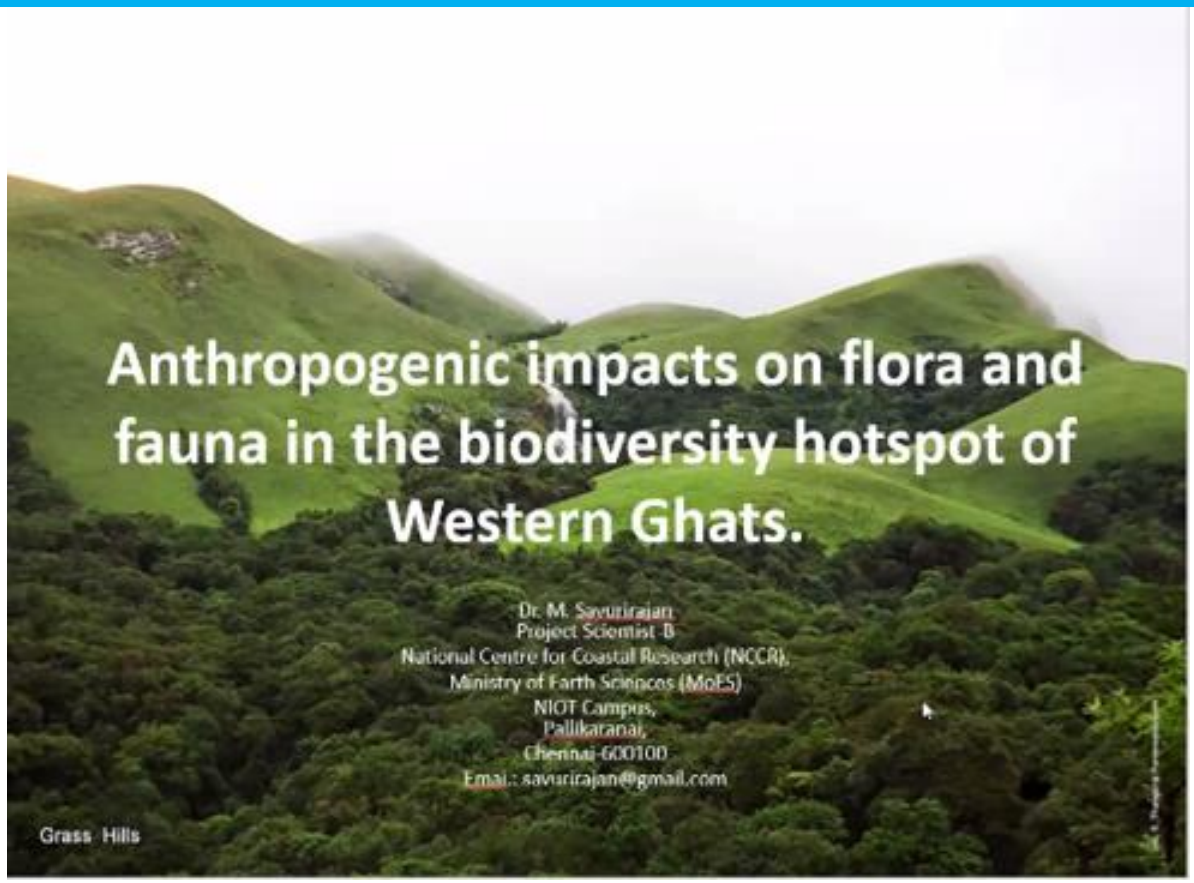
An unofficially recognised sub-division of Geological time,

"a proposed geological epoch dating from the commencement of significant human impact on Earth's geology and ecosystems, including, but not limited to, anthropogenic climate change".

The Idea of Anthropocene From Conrad to Orwell

- The conquest of the earth, which mostly means taking it away from people with different colored skin or flatter noses, is not a pretty thing when you think about it. The only good thing about it is the idea behind it. Not some pretty words you can use to describe it, but a real and powerful idea that men will unselfishly sacrifice themselves for—something that men will bow down to and worship.

- The idea that "science" is progressive and positive. And Science has become an undefinable word like democracy (in Orwells Essay *"not only is there no agreed definition, but the attempt to make one is resisted from all sides."*


Anthropogenic impacts on flora and fauna in the biodiversity hotspot of Western Ghats.
Dr. M. Savurirajan
Project Scientist -B
National Centre for Coastal Research (NCCR),
Ministry of Earth Sciences (MoES)
NIOT Campus,
Pallikaranai,
Chennai-600100
Email.: savurirajan@gmail.com
Grass Hills


Hottest hotspots- Western Ghats
The Western Ghats are internationally recognized as a region of immense global importance for the conservation of biological diversity, besides containing areas of high geological, cultural and aesthetic values.
World Heritage Site, listed the region as the world's eight 'hottest hotspots' of biological diversity.
Older than the Himalaya mountains, it represents geomorphic features of immense importance with unique biophysical and ecological processes.
The site's high montane forest ecosystems influence the Indian monsoon weather pattern.
These mountains cover an area of around 140,000 km² in a 1,600 km long stretch.
It is the exceptionally high level of biological diversity and endemism
It is home to at least 325 globally threatened (IUCN Red Data List) flora, fauna, bird, amphibian, reptile and fish species.
They represents 229 plant species, 31 mammal species, 15 bird species, 43 amphibian species, 5 reptile species and 1 fish species.
Of the total 325 globally threatened species in the Western Ghats, 129 are classified as Vulnerable, 145 as Endangered and 51 as Critically Endangered.
Endangered species such as the lion-tailed Macaque, Nilgiri Tahr and Nilgiri Langur are unique to the area.

Anthropogenic activities

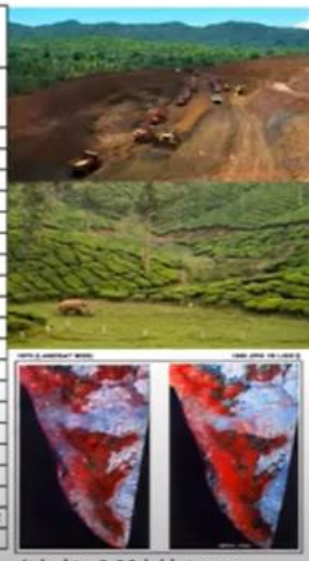
Habitat loss

- A large chunk of the Western Ghats, which primarily stretches across four districts of Karnataka, lost 20,000 hectares (ha) of its area over the last 17 years — putting one of the world's biological hotspots at risk.
  - loss of tree cover- have long-term repercussions, including drying of rivers
  - Experts blame developmental activities like roads, railway projects, increasing urbanisations for these losses.
  - There were many (private) plots of land which had many trees, but these have been turned into housing complexes or tourists resorts

Table1: Loss of tree cover (in ha) in four district of Karnataka

Year	Dakshin Kannada	Kodagu	Udupi	Uttara kannada	Total
2017	955	160	857	236	2,208
2016	1011	175	740	245	2,171
2015	338	71.8	527	117	1,053.8
2014	511	221	503	216	1,451
2013	541	131	589	234	1,495
2012	809	196	439	73	1,517
2011	299	59.6	692	153	1,203.6
2010	325	105	93.6	0	523.6
2009	568	329	283	174	1,354
2008	638	262	241	109	1,250
2007	949	368	352	173	1,842
2006	214	68	205	73.6	560.6
2005	328	170	240	230	968
2004	294	143	85.3	70	592.3
2003	163	249	89.7	63	564.7
2002	179	53	83.1	66.3	381.4
2001	273	145	65.2	51	534.2
Subtot.	8,395	2,906.4	6,084.9	2,283.9	
Total					19,670.2

Source: Global Forest Watch



- Rapid loss in tree cover also means increased carbon dioxide emissions — it led to 2.22 lakh tonne carbon dioxide emissions over the period.
- The human population has grown, people have chopped down the forests and replaced them with spice, tea, coffee, and rubber plantations.

Climate change

- Valleys in the states of Maharashtra, Karnataka and Kerala that weren't considered flood-prone until recently are at risk.
- These floods appear to be getting more severe. Climate change is causing stronger and more erratic rainfall with recurrent floods in low-lying areas.
- And another problem comes from deforestation in the mountain range where much of the water first fell
- Floods and landslides in the mountains, hills, and areas downstream
- Climate change is already having an obvious impact, with unprecedented rains in monsoon seasons and severe drought and dry rivers in summer.
- Deforestation and the use of highly destructive explosives mean these areas are prone to increased seismic tremors and landslides.
- Thousands of illegal stone quarries now also operate in the Ghats, where mountainsides are demolished to generate stones and sand for the construction industry.
- All this makes flooding more severe, as deforestation in the catchment area of a river reduces the land's ability to retain water.

Infrastructure activities

- In the Western Ghats, wind farming is making lizards change colour, says new study.
- As demand for energy increases, India plans to build more dams which in turn could lead to massive deforestation and ecosystem destruction.

- LIVESTOCK GRAZING
- ILLEGAL HUNTING
- HUMAN-WILDLIFE CONFLICT
- EXTRACTION OF FOREST PRODUCTS
- FUELWOOD AND FODDER EXTRACTION
- PLANTATIONS

Asian Elephant conservation in Western Ghats

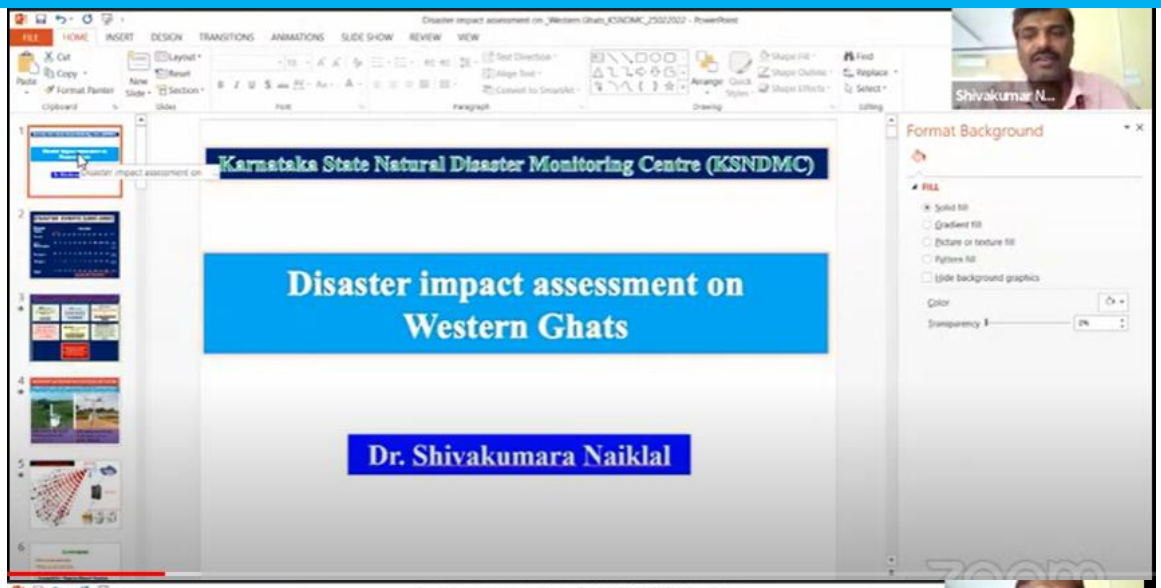
- The Western Ghats including 25% of the global population of Asian Elephants.
- Major threats to the long-term conservation of the elephant include further fragmentation of habitat, continued poaching of bulls for ivory, and escalation in human-elephant conflicts resulting in public antagonism toward the species.
- The fragmentation of habitat occur due to various reasons.
- Anthropogenic pressure in the form of overgrazing by scrub cattle and firewood collection by people that severely degrade the natural habitats
  - Ivory poaching and skewed sex ratio,
  - Isolated elephant herds,
  - Habitat degradation,
  - Elephant mortality by transmission line,
  - Proliferation of exotic weeds and its impact,
  - Forest fire and its impacts and Human-elephant conflict:
- The goals of management should thus be to: (1) consolidate habitats and preserve corridors to avoid further fragmentation; (2) take steps through integrated land use planning at the landscape level to reduce human-elephant conflicts; and (3) build up a demographically and genetically viable elephant population by protecting the tusked males from ivory poaching.

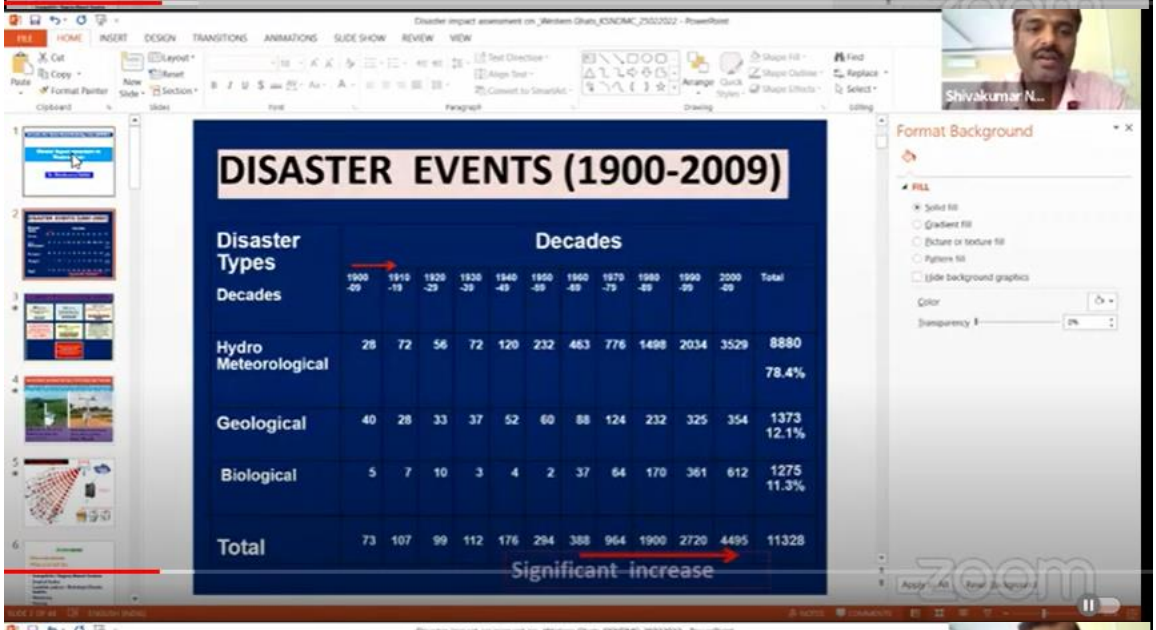
Tigers – in the Western Ghats

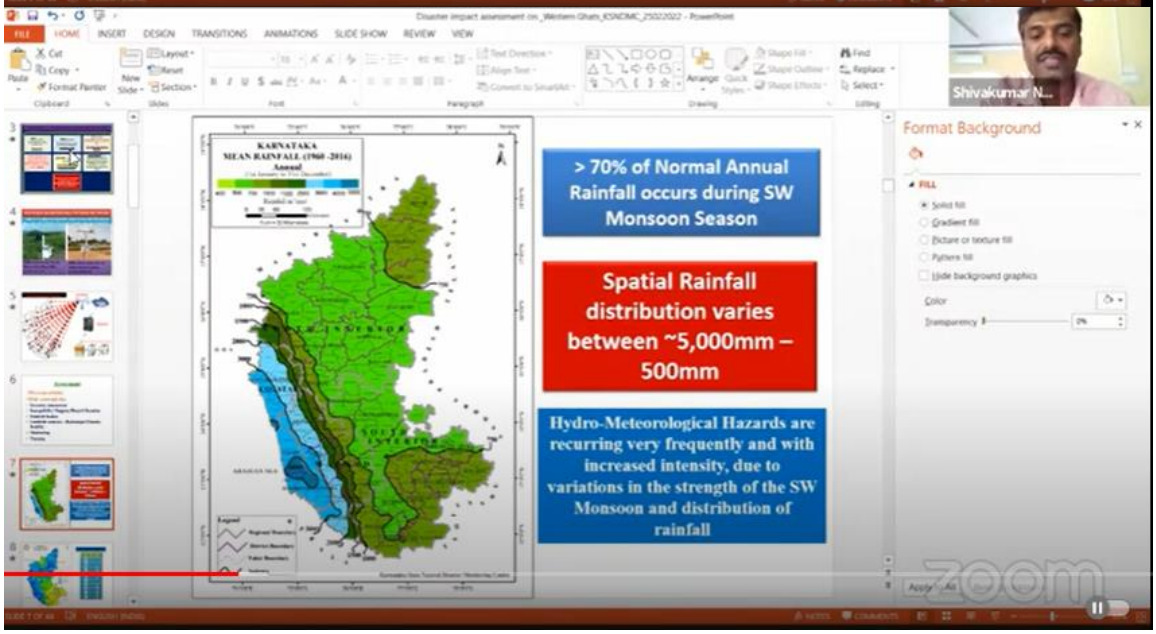
- The current tiger population was estimated at 534 (500 to 568) registering a rise of about 32 per cent since 2006.
- Tigers for dispersal depends on the level of human disturbance; tigers tend to avoid areas with a high human footprint.
- Experts have cited the shrinking habitat in the Western Ghats as a major reason behind the man-animal conflict.
- Tiger habitat is already extremely fragmented
- People who trek and disturb tigers even slightly- including jeep safaris as well as festivals among other activities.
- Illegal wildlife trade , Human wildlife conflict , Habitat loss and fragmentation , Climate change
- Three strategy to manage human-tiger negative interactions 1. Material and logistical support, 2. Restricting habitat interventions and 3. SOPs
- **'Eco-Friendly measures to mitigate impacts of Linear infrastructure on wildlife'** .

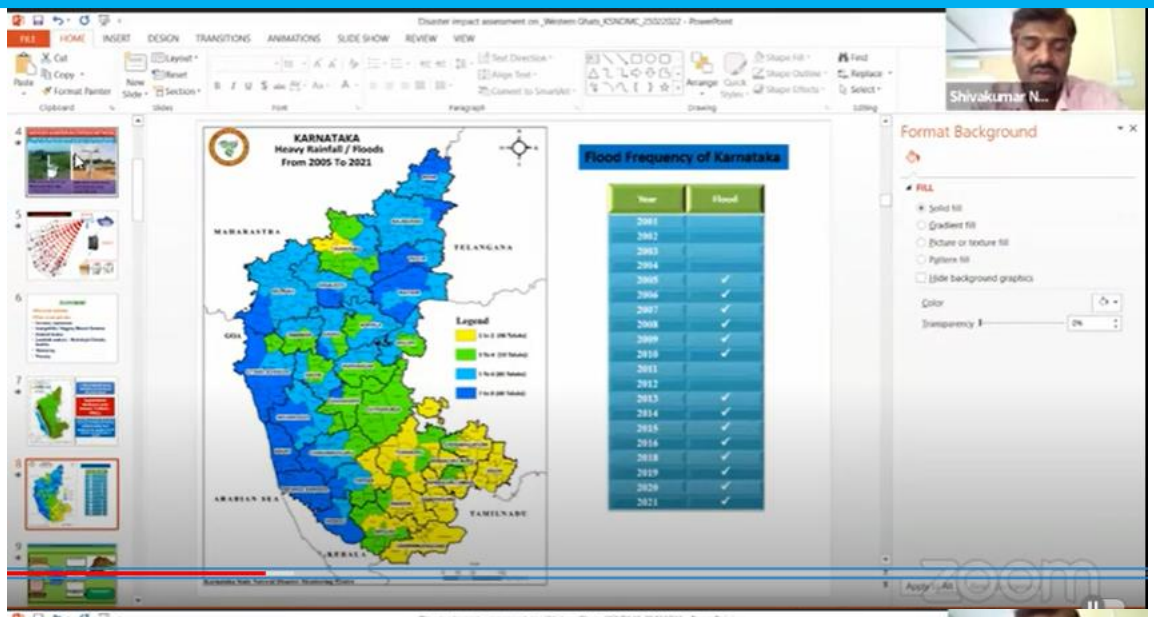
Threats to vegetation- in the Western Ghats

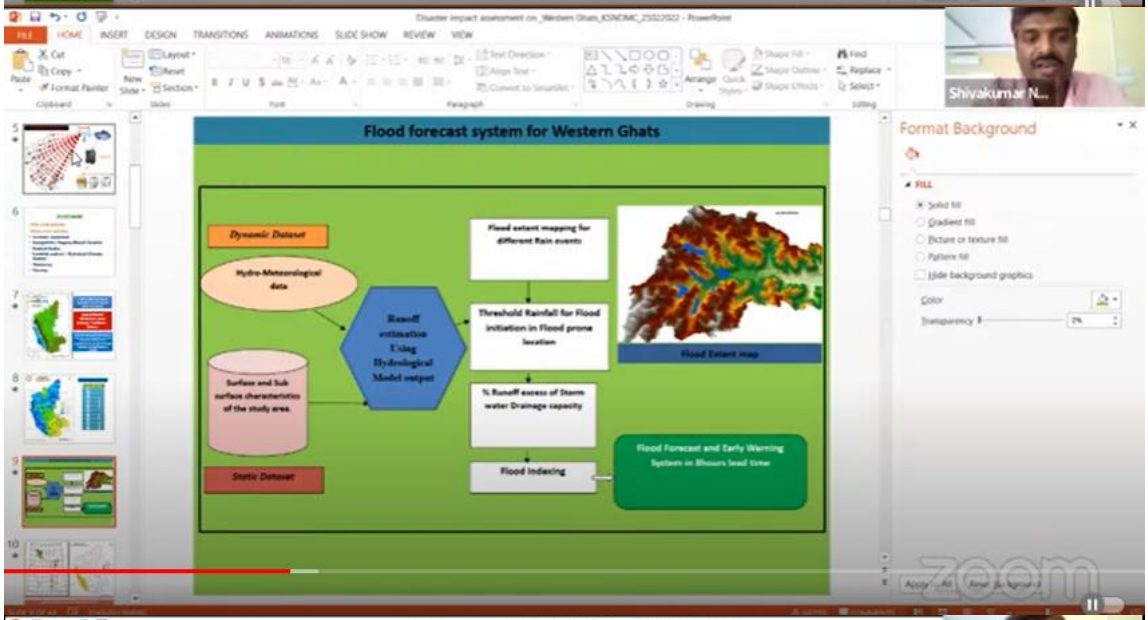
- The ecosystem in India's Western Ghats is severely threatened due to the increasing human settlements, mining, pollution and the drop in genetic diversity.
- Encroachments.
- Human settlements
- Over-exploitation
- Livestock grazing.
- Mining
- Polluting rivers and damaging the top soil.
- Pressure from tourism
- Unchecked use of agrochemicals in tea and coffee plantations

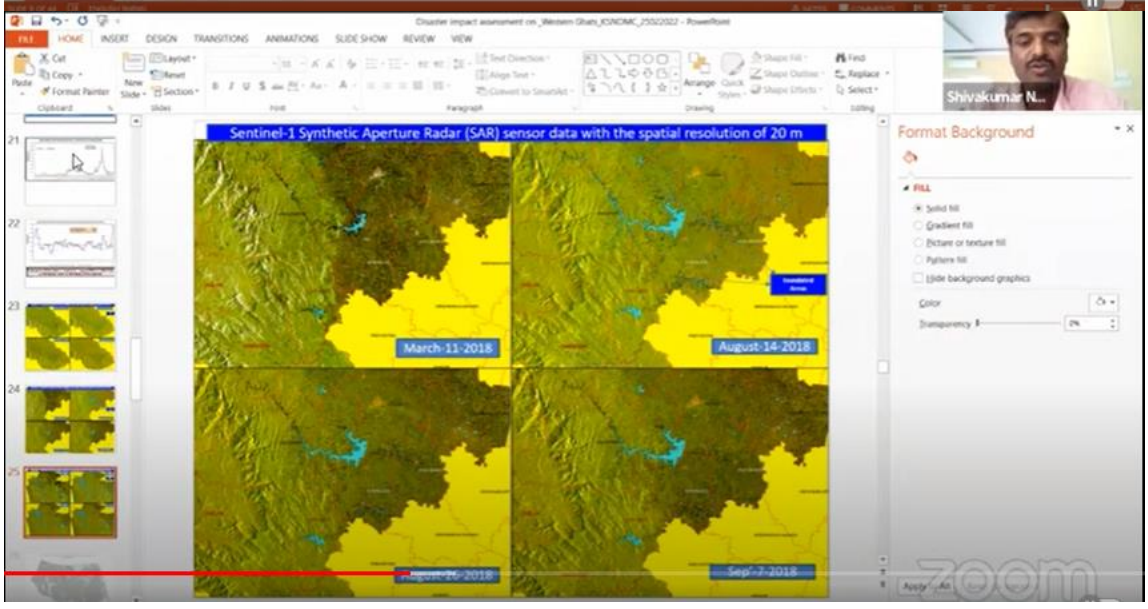

Karnataka State Natural Disaster Monitoring Centre (KSNDMC)
Disaster impact assessment on Western Ghats
Dr. Shivakumara Naiklal
Shivakumar N...
Format Background

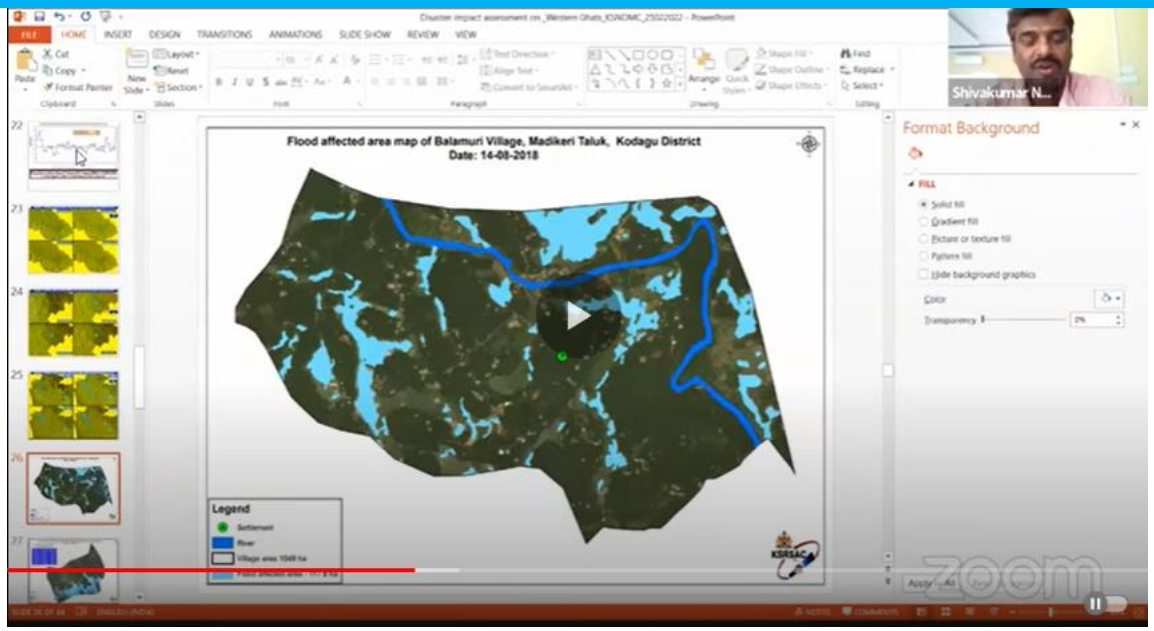

DISASTER EVENTS (1900-2009)
Disaster Types
Decades
Decades
1900 -09
1910 -19
1920 -29
1930 -39
1940 -49
1950 -59
1960 -69
1970 -79
1980 -89
1990 -99
2000 -09
Total
Hydro Meteorological 28 72 56 72 120 232 463 776 1498 2034 3529 8880 78.4%
Geological 40 28 33 37 52 60 88 124 232 325 354 1373 12.1%
Biological 5 7 10 3 4 2 37 64 170 361 612 1275 11.3%
Total 73 107 99 112 176 294 388 964 1900 2720 4495 11328
Significant increase
Shivakumar N...
Format Background

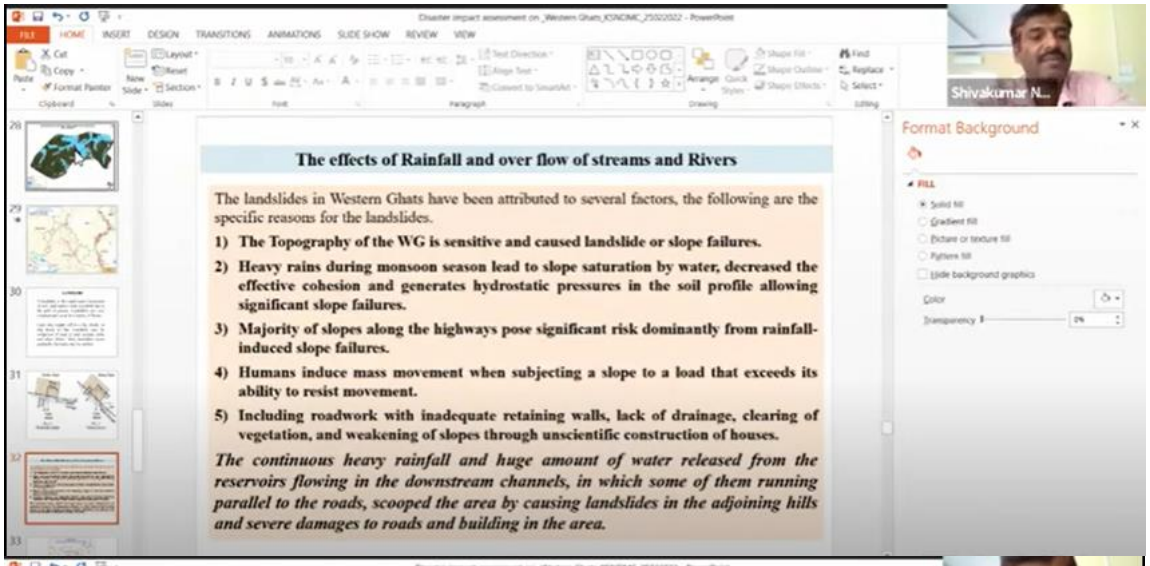

KARNATAKA MEAN RAINFALL (1960 -2016) Annual
> 70% of Normal Annual Rainfall occurs during SW Monsoon Season
Spatial Rainfall distribution varies between ~5,000mm – 500mm
Hydro-Meteorological Hazards are recurring very frequently and with increased intensity, due to variations in the strength of the SW Monsoon and distribution of rainfall
Shivakumar N...
Format Background

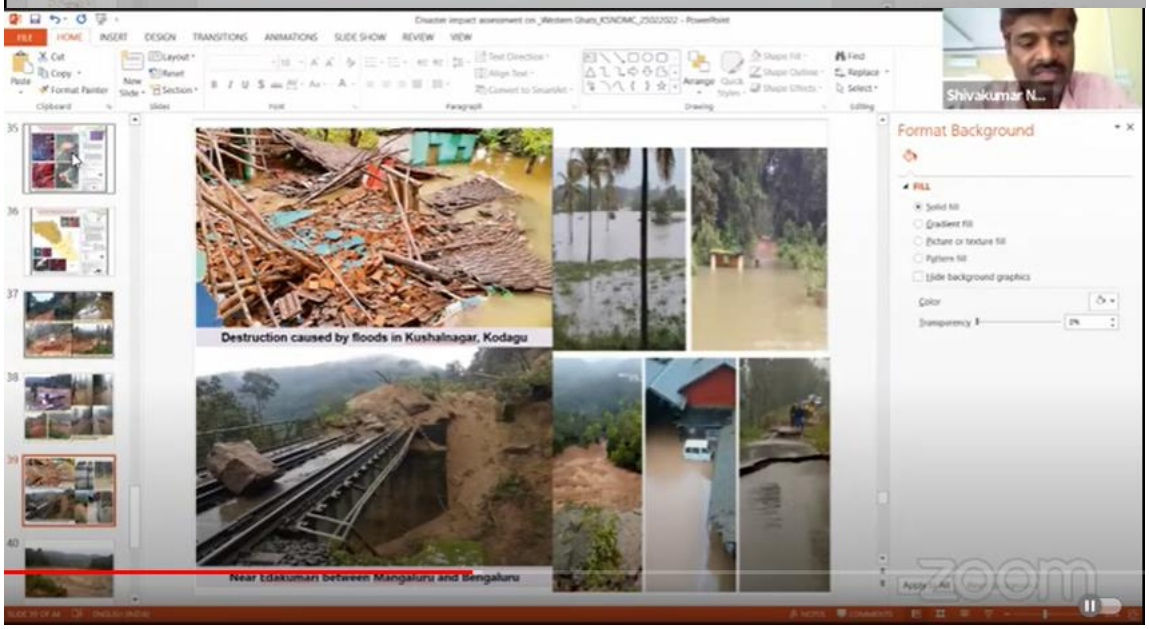

KARNATAKA
Heavy Rainfall / Floods
From 2005 To 2021
Flood Frequency of Karnataka
Year
Flood
Legend
MAHARASHTRA
TELANGANA
GOA
TAMILNADU
KERALA
Shivakumar N...
Format Background


Flood forecast system for Western Ghats
Dynamic Dataset
Hydro-Meteorological data
Runoff estimation Using Hydrological Model output
Surface and Sub surface characteristics of the study area
Static Dataset
Flood extent mapping for different Rain events
Threshold Rainfall for Flood initiation in Flood prone location
% Runoff excess of Storm water Drainage capacity
Flood Indexing
Flood Forecast and Early Warning System in 8hours lead time
Flood Extent map
Shivakumar N...
Format Background

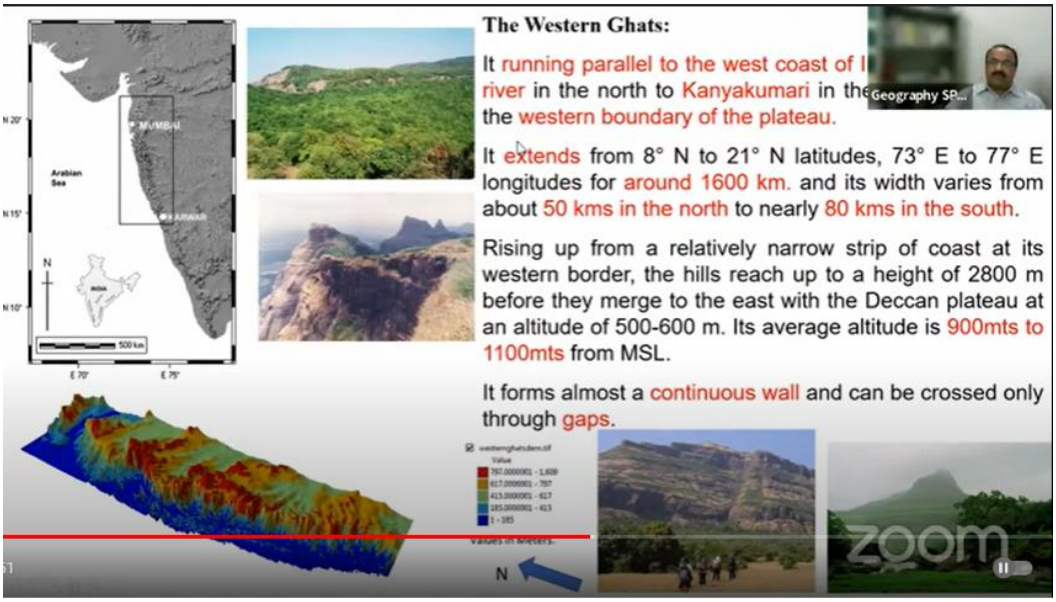

Sentinel-1 Synthetic Aperture Radar (SAR) sensor data with the spatial resolution of 20 m
March-11-2018
August-14-2018
Sept-7-2018
Shivakumar N...
Format Background

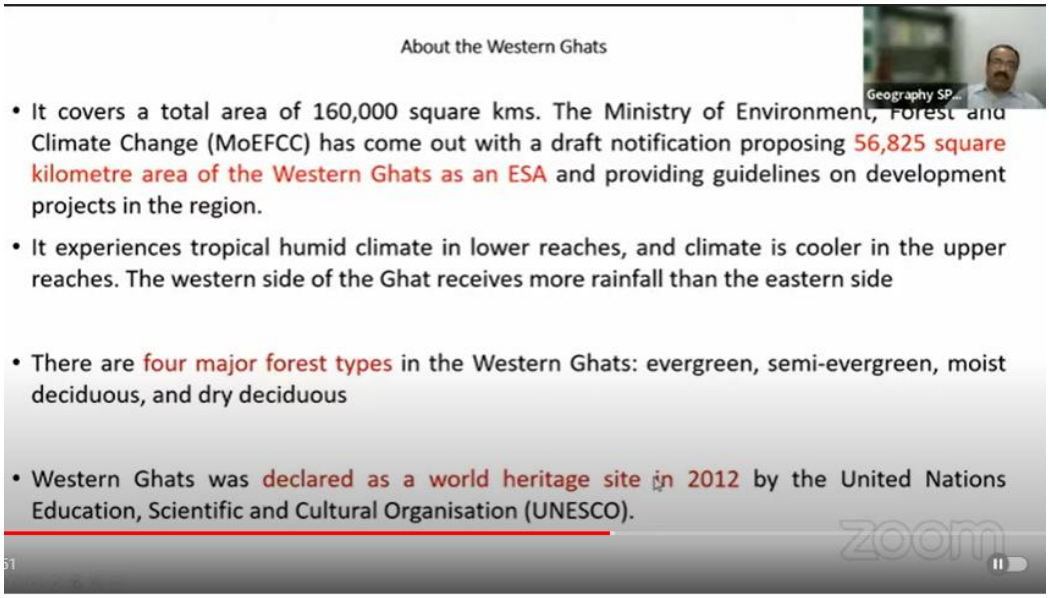

Flood affected area map of Balamuri Village, Madikeri Taluk, Kodagu District
Date: 14-08-2018
Legend
Format Background
Shivakumar N...

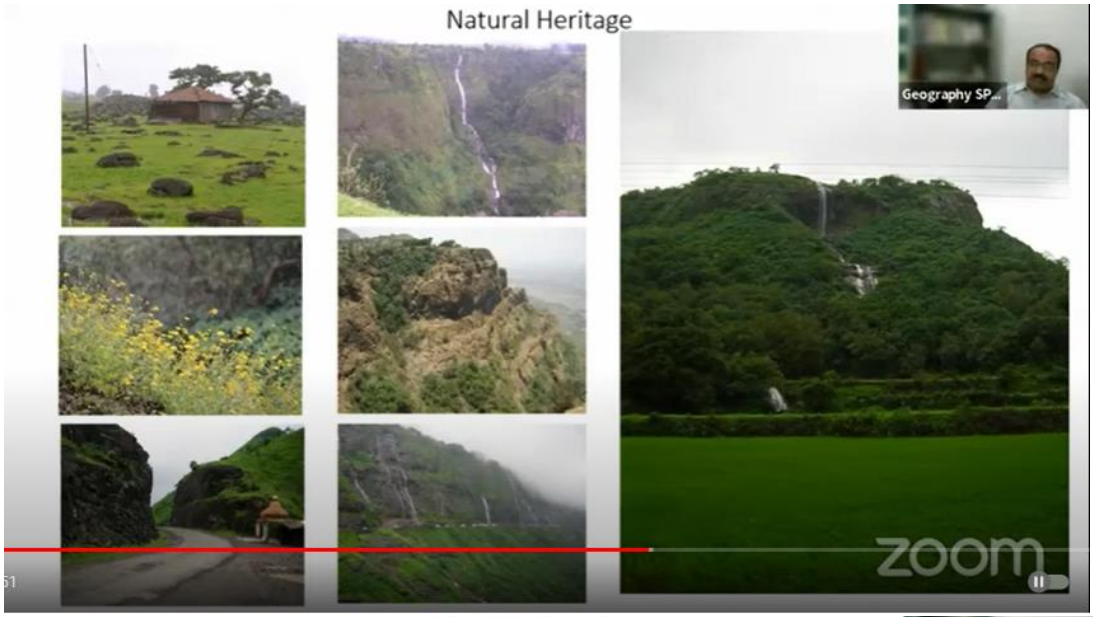

The effects of Rainfall and over flow of streams and Rivers
The landslides in Western Ghats have been attributed to several factors, the following are the specific reasons for the landslides.
1) The Topography of the WG is sensitive and caused landslide or slope failures.
2) Heavy rains during monsoon season lead to slope saturation by water, decreased the effective cohesion and generates hydrostatic pressures in the soil profile allowing significant slope failures.
3) Majority of slopes along the highways pose significant risk dominantly from rainfall-induced slope failures.
4) Humans induce mass movement when subjecting a slope to a load that exceeds its ability to resist movement.
5) Including roadwork with inadequate retaining walls, lack of drainage, clearing of vegetation, and weakening of slopes through unscientific construction of houses.
The continuous heavy rainfall and huge amount of water released from the reservoirs flowing in the downstream channels, in which some of them running parallel to the roads, scooped the area by causing landslides in the adjoining hills and severe damages to roads and building in the area.
Format Background
Shivakumar N...


Destruction caused by floods in Kushalnagar, Kodagu
Near Edakumari between Mangaluru and Bengaluru
Format Background
Shivakumar N...

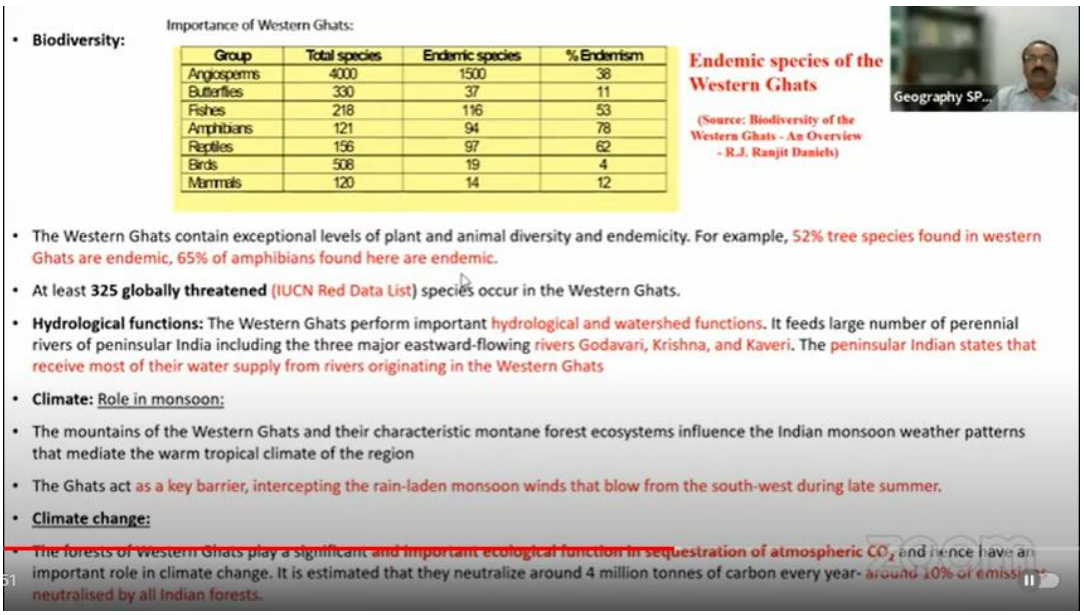

Geography SP...
Shattered Lives in Restless Western Ghats
Need of Disaster Risk Reduction
Professor Ravindra G. Jaybhaye
Department of Geography
Savitribai Phule Pune University,
Pune- 07
zoom


Geography SP...
The Western Ghats:
It running parallel to the west coast of I
river in the north to Kanyakumari in the
the western boundary of the plateau.
It extends from 8° N to 21° N latitudes, 73° E to 77° E longitudes for around 1600 km. and its width varies from about 50 kms in the north to nearly 80 kms in the south.
Rising up from a relatively narrow strip of coast at its western border, the hills reach up to a height of 2800 m before they merge to the east with the Deccan plateau at an altitude of 500-600 m. Its average altitude is 900mts to 1100mts from MSL.
It forms almost a continuous wall and can be crossed only through gaps.
Arabian Sea
N
zoom


Geography SP...
About the Western Ghats
• It covers a total area of 160,000 square kms. The Ministry of Environment, Forest and Climate Change (MoEFCC) has come out with a draft notification proposing 56,825 square kilometre area of the Western Ghats as an ESA and providing guidelines on development projects in the region.
• It experiences tropical humid climate in lower reaches, and climate is cooler in the upper reaches. The western side of the Ghat receives more rainfall than the eastern side
• There are four major forest types in the Western Ghats: evergreen, semi-evergreen, moist deciduous, and dry deciduous
• Western Ghats was declared as a world heritage site in 2012 by the United Nations Education, Scientific and Cultural Organisation (UNESCO).
zoom


Natural Heritage
Geography SP...
zoom


Cultural Heritage Junnar
Geography SP...
zoom


Biodiversity:
Importance of Western Ghats:
Group | Total species | Endemic species | % Endemism
Angiosperms | 4000 | 1500 | 38
Butterflies | 330 | 37 | 11
Fishes | 218 | 116 | 53
Amphibians | 121 | 94 | 78
Reptiles | 156 | 97 | 62
Birds | 508 | 19 | 4
Mammals | 120 | 14 | 12
Endemic species of the Western Ghats
(Source: Biodiversity of the Western Ghats - An Overview - R.J. Ranjit Daniels)
Geography SP...
The Western Ghats contain exceptional levels of plant and animal diversity and endemicity. For example, 52% tree species found in western Ghats are endemic, 65% of amphibians found here are endemic.
At least 325 globally threatened (IUCN Red Data List) species occur in the Western Ghats.
Hydrological functions: The Western Ghats perform important hydrological and watershed functions. It feeds large number of perennial rivers of peninsular India including the three major eastward-flowing rivers Godavari, Krishna, and Kaveri. The peninsular Indian states that receive most of their water supply from rivers originating in the Western Ghats
Climate: Role in monsoon:
The mountains of the Western Ghats and their characteristic montane forest ecosystems influence the Indian monsoon weather patterns that mediate the warm tropical climate of the region
The Ghats act as a key barrier, intercepting the rain-laden monsoon winds that blow from the south-west during late summer.
Climate change:
The forests of Western Ghats play a significant and important ecological function in sequestration of atmospheric CO_2 and hence have an important role in climate change. It is estimated that they neutralize around 4 million tonnes of carbon every year- around 10% of emissions neutralised by all Indian forests.

Economic importance:

- The Western Ghats are rich in iron, manganese and bauxite ores in parts of their ranges
- Pepper and cardamom, which are native to the evergreen forests of the Western Ghats have been taken up as plantation crops on a large scale. Other large scale plantations include tea, coffee, oil palm and rubber.
- The forests of Western Ghats are important source of timber and support a large number of forest-based industries such as paper, plywood, poly-fibres and matchwood.
- The forest based communities of western Ghats have been deriving sustenance from the forest by collecting non-timber forest produce (NTFP)
- There are number of tourist centres that have sprung up in the Western Ghats; example: Ooty, Thekaddy WS etc. There has been important pilgrimage centres in the region- prominent amongst these being Sabarimalai in Kerala, Madeveshwaramalai in Karnataka and Mahabaleshwar in Maharashtra.

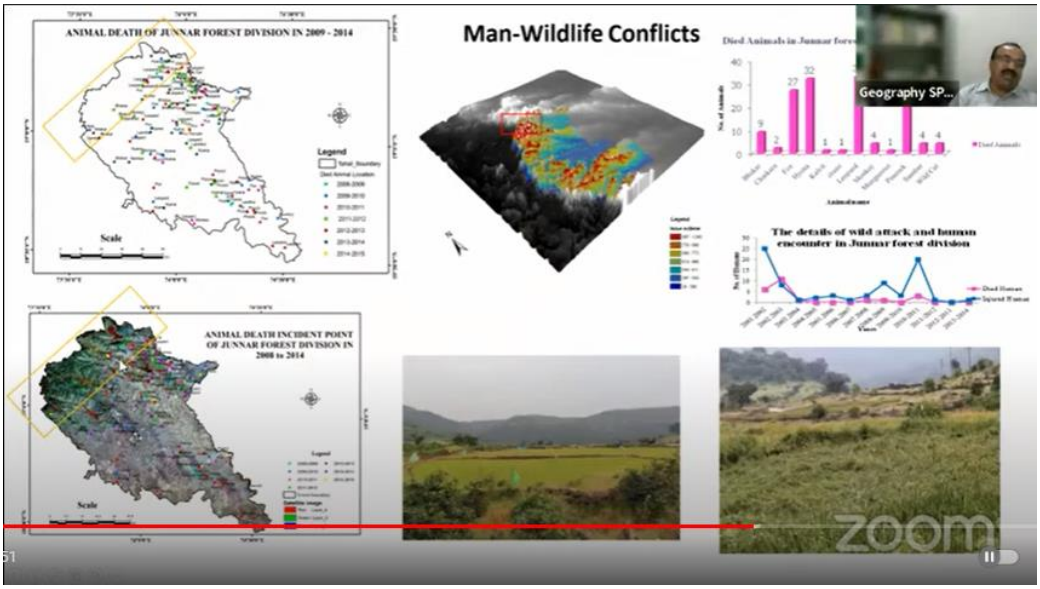
Threats to Western Ghats:

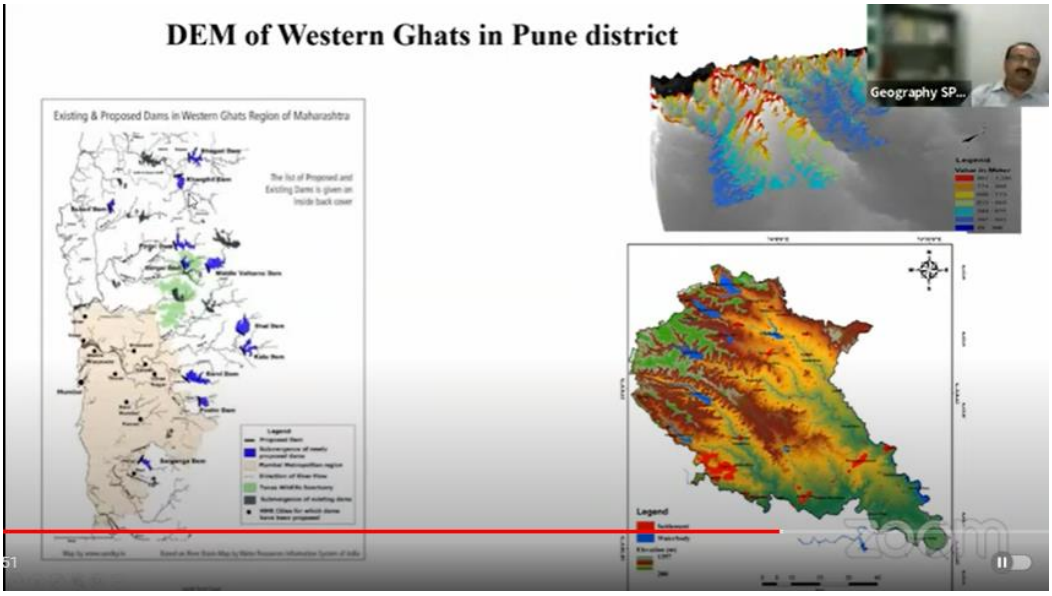
- **Mining:** With a steep increase in iron ore prices and demand for lower grade or activities have grown rapidly especially in Goa and often in violation of all laws, serious environmental damage and social disruption.
- Sand mining has emerged as a major threat in Kerala. Unsustainable mining has increased vulnerability to landslides, damaged water sources and agriculture, thus **negatively affected the livelihoods of the people** living in those areas
- **Livestock Grazing**: Livestock grazing within and bordering protected areas by high densities of livestock (cattle and goats) is a serious problem **causing habitat degradation** across the Western Ghats.
- **Human-wildlife conflict:** Given that the Western Ghats exists within an intensely human-dominated landscape, human-wildlife conflicts are a common phenomenon. For example, villagers living close to Bhadra Wildlife Sanctuary in the State of Karnataka, lose approximately 11 percent of their annual grain production to raiding elephants annually (CEPF).
- **Extraction of forest produce:** Human communities living within and adjacent to protected areas in the Western Ghats are often dependent on extraction of NTFPs to meet a diversity of subsistence and commercial needs. With rising population and changing consumption patterns, sustainability of NTFP is a critical issue.

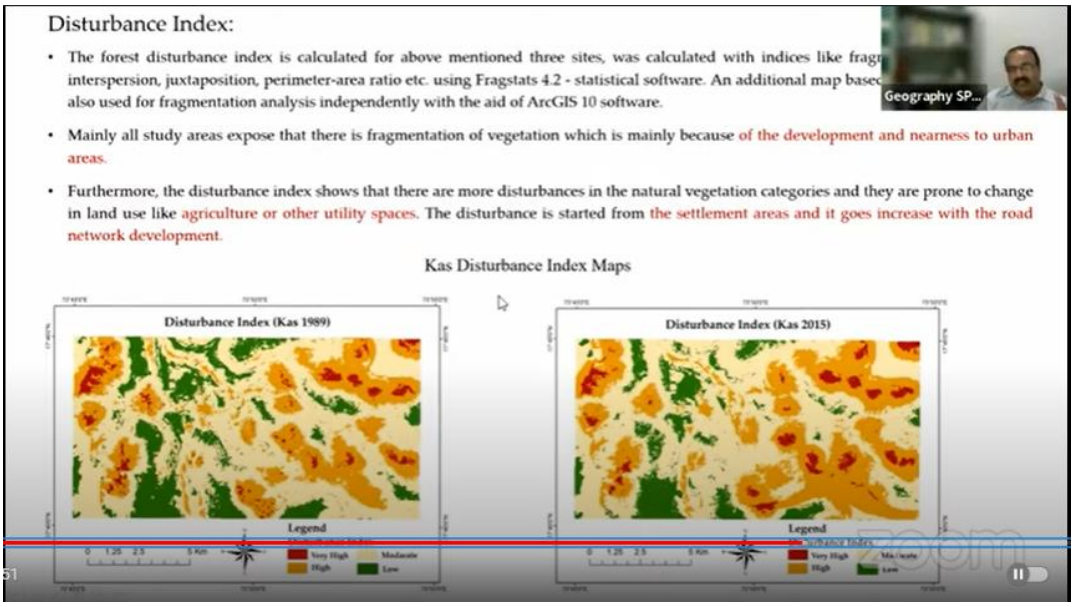
- **Plantations**: Plantations owned by private individuals and corporate sector co in the Western Ghats and constitute an important source of fragmentation of habitat.
- **Encroachment by human settlements:** Human settlements where legal and/or traditional rights of land ownership occur both within and outside protected areas all across the Western Ghats and represent a significant landscape level threat.
- **Pollution**: The unrestricted use of agrochemicals in the vicinity of forests, particularly in tea and coffee estates, causes **serious damage to aquatic and forest ecosystems**.
- **Hydropower projects and Large dams**: Large dam projects in Western Ghats have resulted in environmental and social disruption despite cost benefit analyses and environmental impact assessments being done by the government and companies
- **Deforestation:** Conversion of forest land into agricultural land or for commercial purpose like tourism, illegal logging for timber have had significant negative effects on biodiversity.
- **Climate change:** The changes in land use and deforestation have led to big variations in the duration and intensity of rainfalls. Climate change has been considered as a cause of floods in many regions in recent past. Increasing EWE.


Geography SP...
zoom

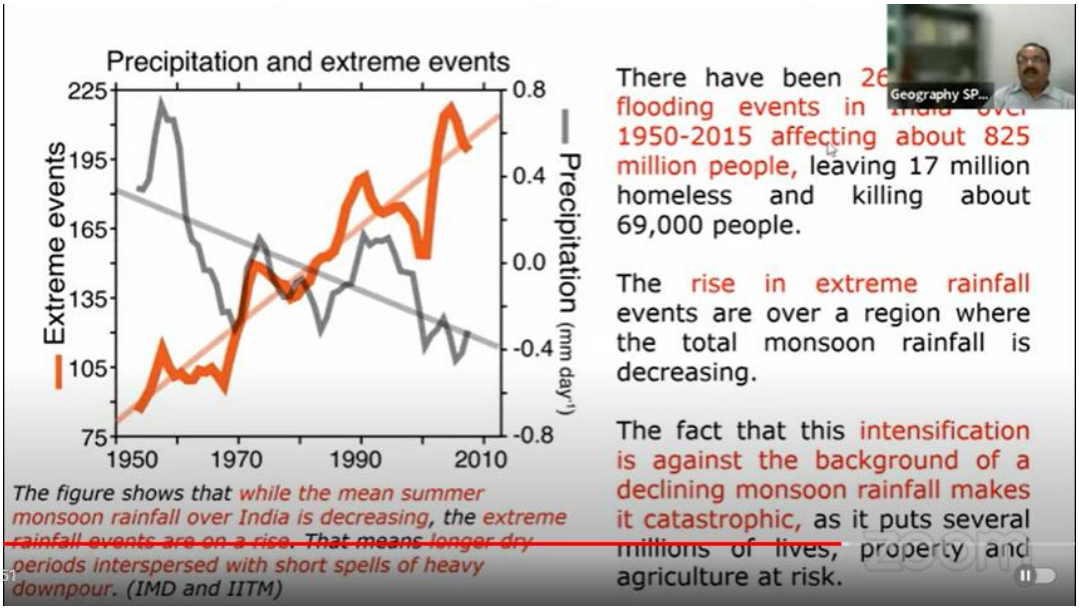

Geography SP...
zoom

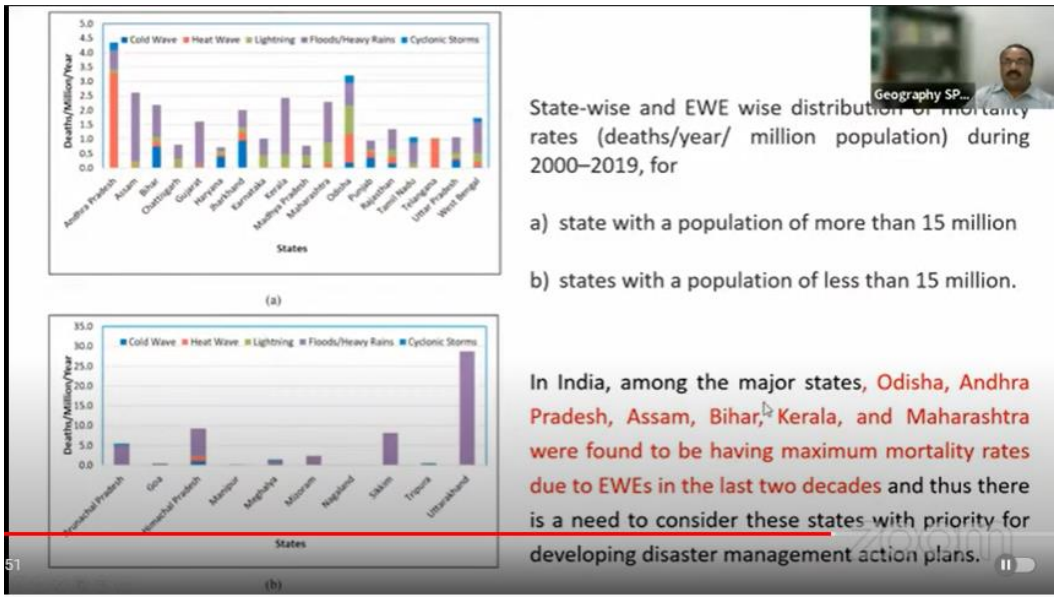

ANIMAL DEATH OF JUNNAR FOREST DIVISION IN 2009 - 2014
Legend
Scale
Man-Wildlife Conflicts
Geography SP...
The details of wild attack and human encounter in Junnar forest division
ANIMAL DEATH INCIDENT POINT OF JUNNAR FOREST DIVISION IN 2008 to 2014
Legend
Scale
zoom

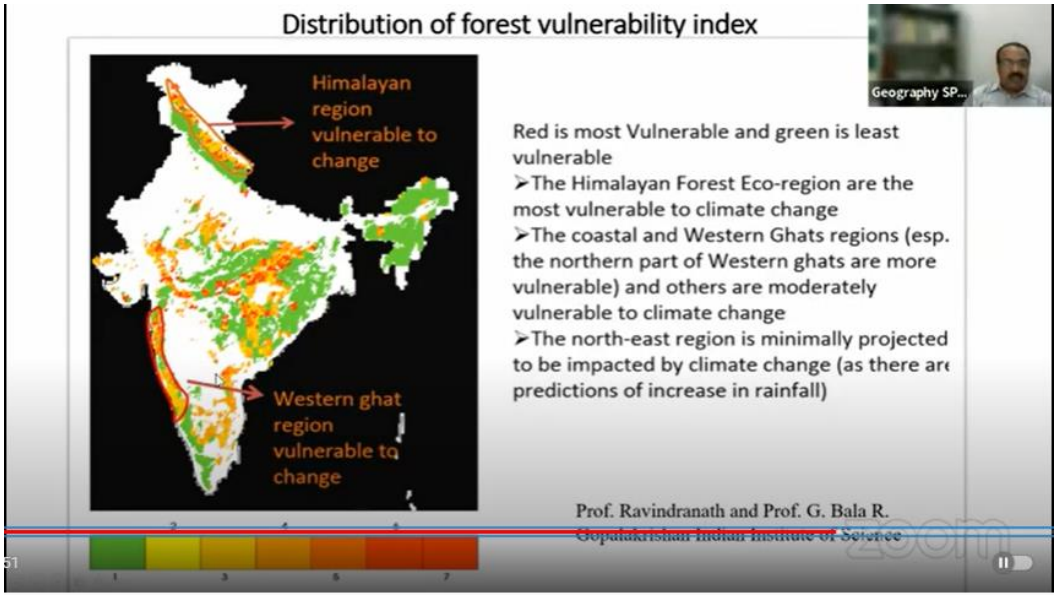

DEM of Western Ghats in Pune district
Existing & Proposed Dams in Western Ghats Region of Maharashtra
Geography SP...
Legend
zoom


Disturbance Index:
The forest disturbance index is calculated for above mentioned three sites, was calculated with indices like fragi
interspersion, juxtaposition, perimeter-area ratio etc. using Fragstats 4.2 - statistical software. An additional map basec
also used for fragmentation analysis independently with the aid of ArcGIS 10 software.
Mainly all study areas expose that there is fragmentation of vegetation which is mainly because of the development and nearness to urban areas.
Furthermore, the disturbance index shows that there are more disturbances in the natural vegetation categories and they are prone to change in land use like agriculture or other utility spaces. The disturbance is started from the settlement areas and it goes increase with the road network development.
Kas Disturbance Index Maps
Disturbance Index (Kas 1989)
Disturbance Index (Kas 2015)
Legend
Geography SP...
zoom


Geography SP...
zoom


Precipitation and extreme events
Extreme events
Precipitation (mm day-1)
225
195
165
135
105
75
0.8
0.4
0.0
-0.4
-0.8
1950
1970
1990
2010
The figure shows that while the mean summer monsoon rainfall over India is decreasing, the extreme rainfall events are on a rise. That means longer dry periods interspersed with short spells of heavy downpour. (IMD and IITM)
There have been 26 flooding events in India over 1950-2015 affecting about 825 million people, leaving 17 million homeless and killing about 69,000 people.
The rise in extreme rainfall events are over a region where the total monsoon rainfall is decreasing.
The fact that this intensification is against the background of a declining monsoon rainfall makes it catastrophic, as it puts several millions of lives, property and agriculture at risk.
Geography SP...


Cold Wave
Heat Wave
Lightning
Floods/Heavy Rains
Cyclonic Storms
Deaths/Million/Year
States
(a)
(b)
State-wise and EWE wise distribution of mortality rates (deaths/year/ million population) during 2000–2019, for
a) state with a population of more than 15 million
b) states with a population of less than 15 million.
In India, among the major states, Odisha, Andhra Pradesh, Assam, Bihar, Kerala, and Maharashtra were found to be having maximum mortality rates due to EWEs in the last two decades and thus there is a need to consider these states with priority for developing disaster management action plans.
Geography SP...


Distribution of forest vulnerability index
Himalayan region vulnerable to change
Western ghat region vulnerable to change
Red is most Vulnerable and green is least vulnerable
➢The Himalayan Forest Eco-region are the most vulnerable to climate change
➢The coastal and Western Ghats regions (esp. the northern part of Western ghats are more vulnerable) and others are moderately vulnerable to climate change
➢The north-east region is minimally projected to be impacted by climate change (as there are predictions of increase in rainfall)
Prof. Ravindranath and Prof. G. Bala R.
Gopalakrishnan Indian Institute of Science
Geography SP...

Biodiversity Hotspots-British Ecologist Norman Myers defined biodiversity Hotspot concept in 1988.

Def. - *"Hotspot are the regions that harbour a great diversity of endemic species and at the same time have been significantly impacted and altered by human activities".*

Criterion of selecting biodiversity Hotspots-

- ❖ No. of Endemic Species i.e. the species which are found no where else.
- ❖ Degree of threat, which is measured in terms of Habitat loss.

-1)Must support 1500 endemic plant species.

2) Must have lost 70% of its original habitat.

Introduction

✓**The Western Ghats : rich in biodiversity and cultural heritage.**

✓This region is a harbour of great diversity of endemic species and at the same time have impacted and altered by human activities (anthropogenic pressure); hence, constitute one of the Hot Spot areas identified at International level by UN.

✓Western Ghats Ecology Expert Panel (WGEEP) has designated the entire Western Ghats as an Ecologically Sensitive Area (ESA) and, assigned three levels of Ecological Sensitivity to different regions of it. (Madhav Gadgil et al 2011) Out of the estimated 1,64,280 sq km of the *Western-Ghats area*, the natural landscape constitutes only 41 per cent. The area identified as **ecologically sensitive** is about 90 % of the natural landscape (Kasturirangan and et. al.,HLWG, 2013).

✓ Hence on the basis of Gadgil (2011) and Kasturirangan (2013) reports on Western Ghats, the government of India planned to impose restrictions on the economic and development activities, which are causing degradation in to this area.

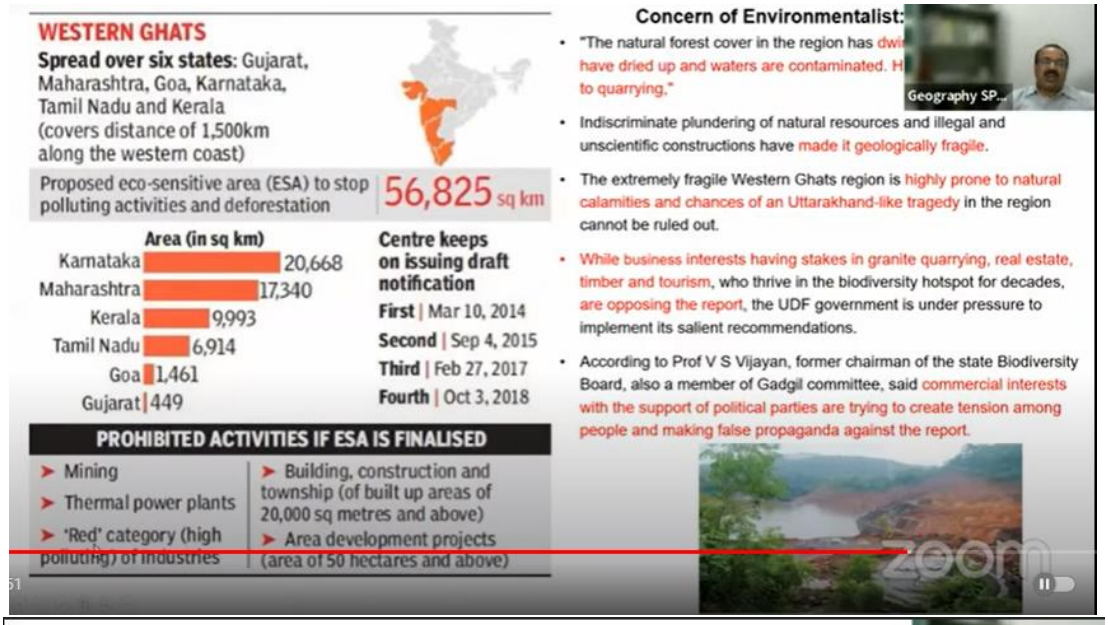
✓"An ecological sensitive area (ESA) is a bio-climatic unit (as demarcated by entire landscapes) in the Western Ghats wherein human impacts have locally caused irreversible changes in the structure of biological communities (as evident in number/ composition of species and their relative abundances) and their natural habitats".

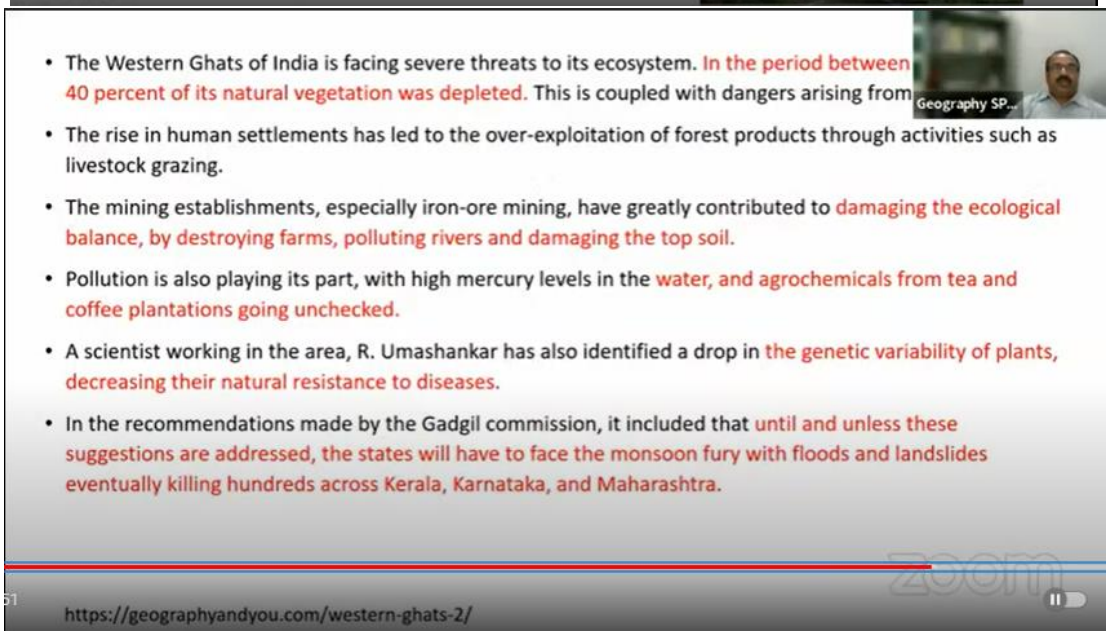
✓It has created unrest among the local people. On the background of this dilemma on environment and development.

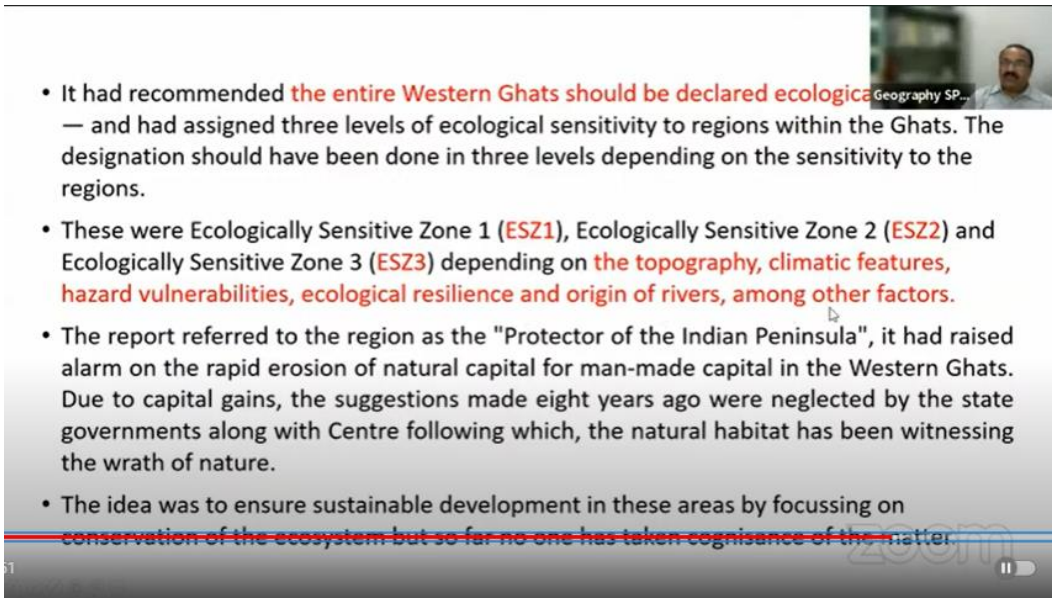
Ecological Fragile Area:

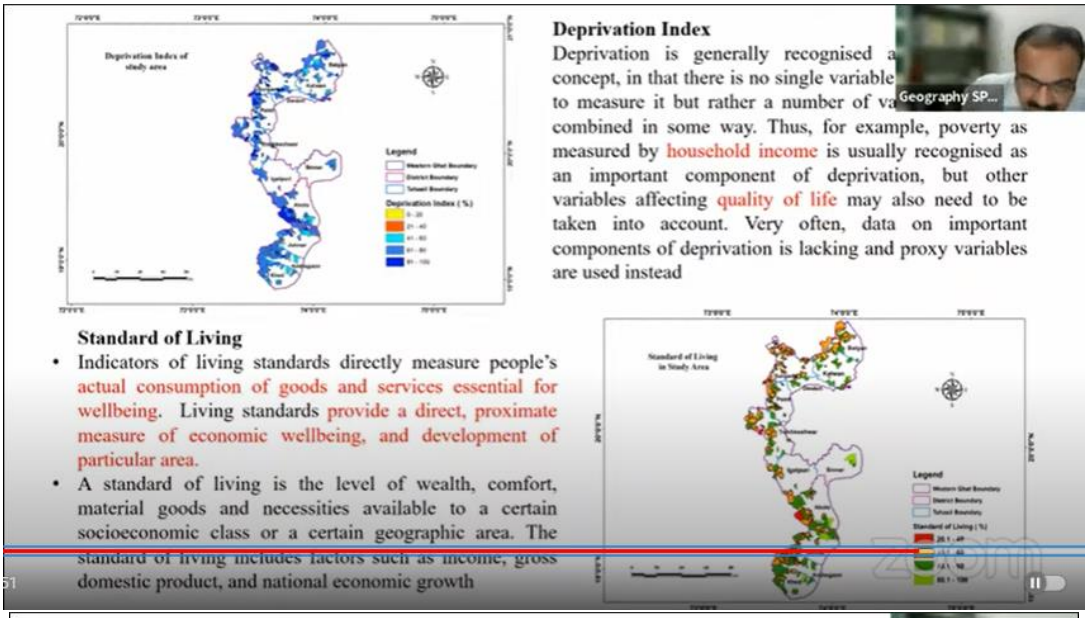
- Ecologically fragile area is an extremely sensitive highly ecological area with
- High susceptibility to anthropogenic stress,
- Highly altered natural habitats,
- Seriously threatened biodiversity, and
- Very delicately balanced and unstable abiotic and biotic conditions.

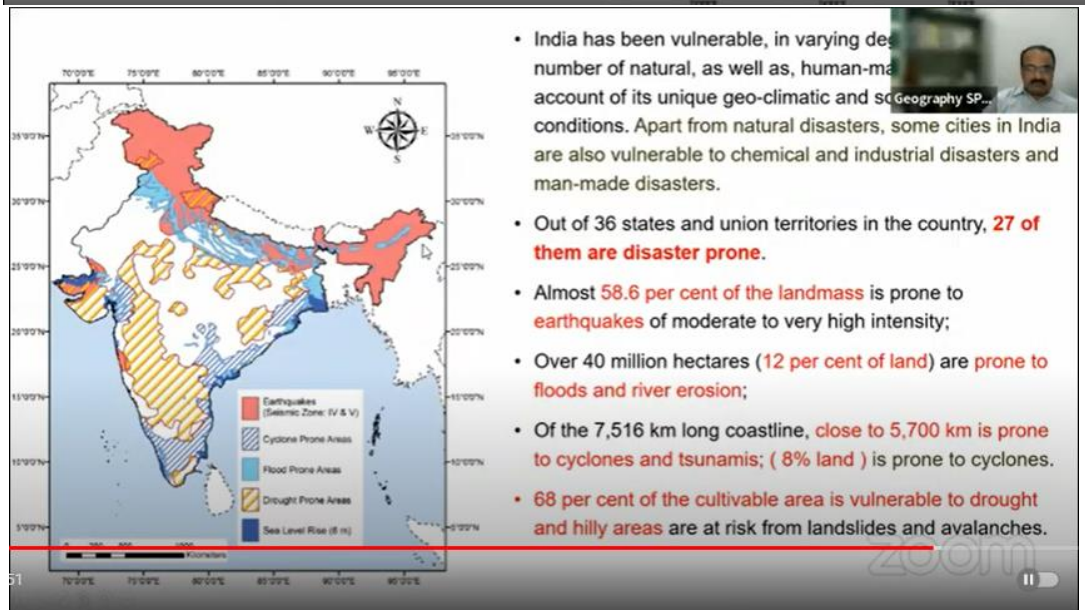
- Ecologically fragile areas require immediate and far sighted conservation measures to save them from permanent and irreparable damage and destruction.

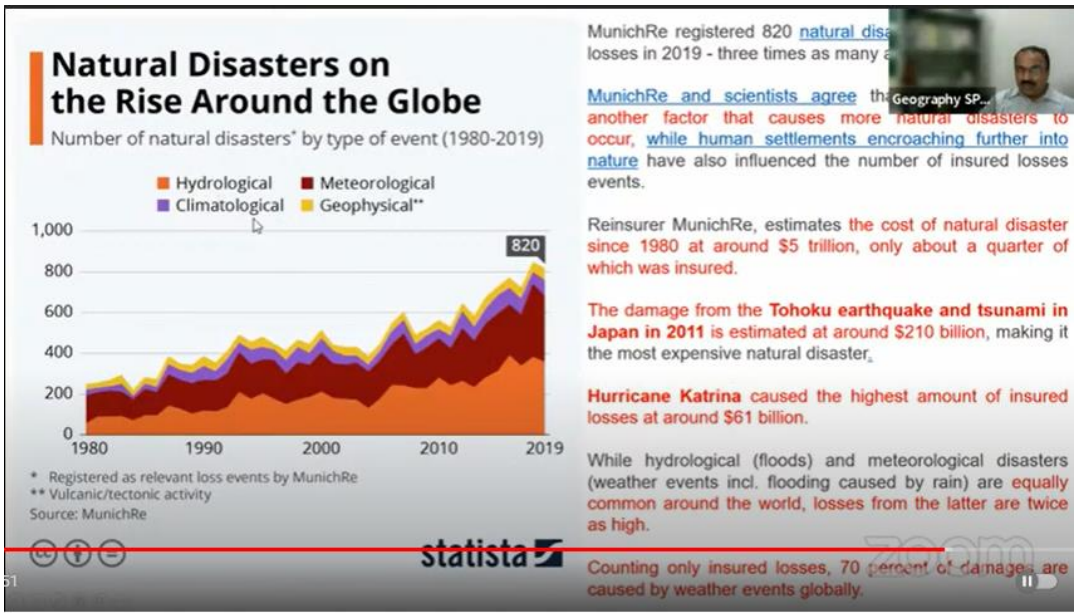

WESTERN GHATS
Spread over six states: Gujarat, Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala (covers distance of 1,500km along the western coast)
Proposed eco-sensitive area (ESA) to stop polluting activities and deforestation
56,825 sq km
Area (in sq km)
Karnataka 20,668
Maharashtra 17,340
Kerala 9,993
Tamil Nadu 6,914
Goa 1,461
Gujarat 449
Centre keeps on issuing draft notification
First | Mar 10, 2014
Second | Sep 4, 2015
Third | Feb 27, 2017
Fourth | Oct 3, 2018
PROHIBITED ACTIVITIES IF ESA IS FINALISED
Mining
Thermal power plants
'Red' category (high polluting) of industries
Building, construction and township (of built up areas of 20,000 sq metres and above)
Area development projects (area of 50 hectares and above)
Concern of Environmentalist:
"The natural forest cover in the region has dwi
have dried up and waters are contaminated. H
to quarrying."
Indiscriminate plundering of natural resources and illegal and unscientific constructions have made it geologically fragile.
The extremely fragile Western Ghats region is highly prone to natural calamities and chances of an Uttarakhand-like tragedy in the region cannot be ruled out.
While business interests having stakes in granite quarrying, real estate, timber and tourism, who thrive in the biodiversity hotspot for decades, are opposing the report, the UDF government is under pressure to implement its salient recommendations.
According to Prof V S Vijayan, former chairman of the state Biodiversity Board, also a member of Gadgil committee, said commercial interests with the support of political parties are trying to create tension among people and making false propaganda against the report.
Geography SP...
zoom

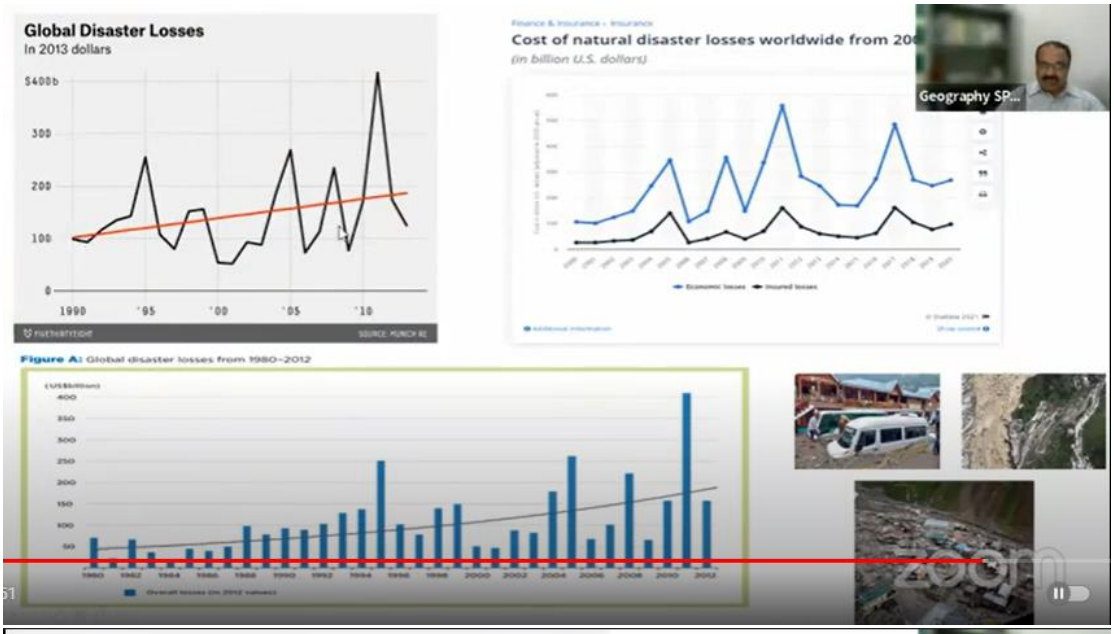

The Western Ghats of India is facing severe threats to its ecosystem. In the period between
40 percent of its natural vegetation was depleted. This is coupled with dangers arising from
The rise in human settlements has led to the over-exploitation of forest products through activities such as livestock grazing.
The mining establishments, especially iron-ore mining, have greatly contributed to damaging the ecological balance, by destroying farms, polluting rivers and damaging the top soil.
Pollution is also playing its part, with high mercury levels in the water, and agrochemicals from tea and coffee plantations going unchecked.
A scientist working in the area, R. Umashankar has also identified a drop in the genetic variability of plants, decreasing their natural resistance to diseases.
In the recommendations made by the Gadgil commission, it included that until and unless these suggestions are addressed, the states will have to face the monsoon fury with floods and landslides eventually killing hundreds across Kerala, Karnataka, and Maharashtra.
https://geographyandyou.com/western-ghats-2/
Geography SP...
zoom

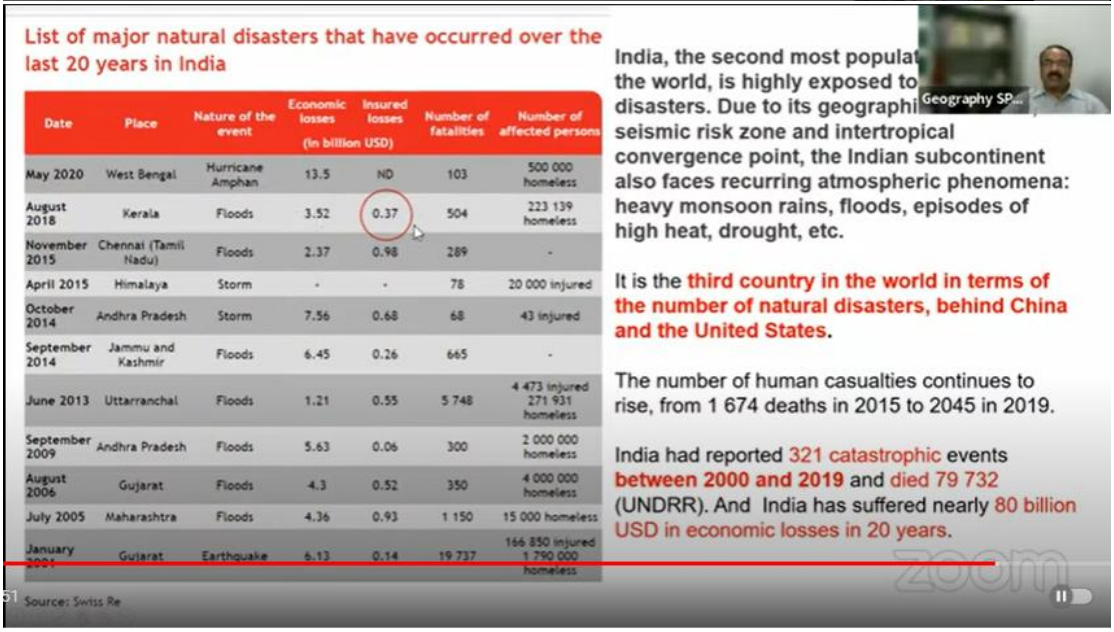

It had recommended the entire Western Ghats should be declared ecologica
— and had assigned three levels of ecological sensitivity to regions within the Ghats. The designation should have been done in three levels depending on the sensitivity to the regions.
These were Ecologically Sensitive Zone 1 (ESZ1), Ecologically Sensitive Zone 2 (ESZ2) and Ecologically Sensitive Zone 3 (ESZ3) depending on the topography, climatic features, hazard vulnerabilities, ecological resilience and origin of rivers, among other factors.
The report referred to the region as the "Protector of the Indian Peninsula", it had raised alarm on the rapid erosion of natural capital for man-made capital in the Western Ghats. Due to capital gains, the suggestions made eight years ago were neglected by the state governments along with Centre following which, the natural habitat has been witnessing the wrath of nature.
The idea was to ensure sustainable development in these areas by focussing on
conservation of the ecosystem but so far no one has taken cognisance of the matter.
Geography SP...
zoom

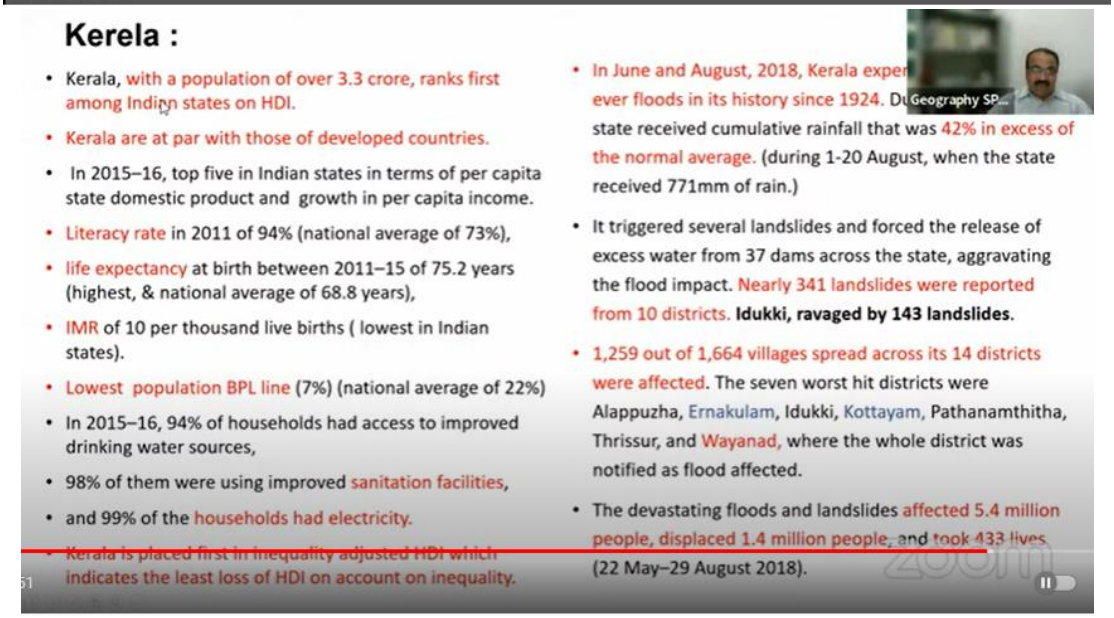

Deprivation Index
Deprivation is generally recognised a concept, in that there is no single variable to measure it but rather a number of va combined in some way. Thus, for example, poverty as measured by household income is usually recognised as an important component of deprivation, but other variables affecting quality of life may also need to be taken into account. Very often, data on important components of deprivation is lacking and proxy variables are used instead
Standard of Living
Indicators of living standards directly measure people's actual consumption of goods and services essential for wellbeing. Living standards provide a direct, proximate measure of economic wellbeing, and development of particular area.
A standard of living is the level of wealth, comfort, material goods and necessities available to a certain socioeconomic class or a certain geographic area. The standard of living includes factors such as income, gross domestic product, and national economic growth
Geography SP...


India has been vulnerable, in varying de number of natural, as well as, human-ma account of its unique geo-climatic and sc conditions. Apart from natural disasters, some cities in India are also vulnerable to chemical and industrial disasters and man-made disasters.
Out of 36 states and union territories in the country, 27 of them are disaster prone.
Almost 58.6 per cent of the landmass is prone to earthquakes of moderate to very high intensity;
Over 40 million hectares (12 per cent of land) are prone to floods and river erosion;
Of the 7,516 km long coastline, close to 5,700 km is prone to cyclones and tsunamis; (8% land) is prone to cyclones.
68 per cent of the cultivable area is vulnerable to drought and hilly areas are at risk from landslides and avalanches.
Earthquakes (Seismic Zone: IV & V)
Cyclone Prone Areas
Flood Prone Areas
Drought Prone Areas
Sea Level Rise (6 m)
Geography SP...


Natural Disasters on the Rise Around the Globe
Number of natural disasters* by type of event (1980-2019)
Hydrological
Meteorological
Climatological
Geophysical**
1,000
800
600
400
200
0
820
1980
1990
2000
2010
2019
* Registered as relevant loss events by MunichRe
** Vulcanic/tectonic activity
Source: MunichRe
statista
MunichRe registered 820 natural disa losses in 2019 - three times as many a
MunichRe and scientists agree th another factor that causes more natural disasters to occur, while human settlements encroaching further into nature have also influenced the number of insured losses events.
Reinsurer MunichRe, estimates the cost of natural disaster since 1980 at around $5 trillion, only about a quarter of which was insured.
The damage from the Tohoku earthquake and tsunami in Japan in 2011 is estimated at around $210 billion, making it the most expensive natural disaster.
Hurricane Katrina caused the highest amount of insured losses at around $61 billion.
While hydrological (floods) and meteorological disasters (weather events incl. flooding caused by rain) are equally common around the world, losses from the latter are twice as high.
Counting only insured losses, 70 percent of damages are caused by weather events globally.
Geography SP...


Global Disaster Losses
In 2013 dollars
$400b
300
200
100
0
1980
'85
'90
'95
'00
'05
'10
Cost of natural disaster losses worldwide from 20
(in billion U.S. dollars)
Geography SP...
Figure A: Global disaster losses from 1980–2012


List of major natural disasters that have occurred over the last 20 years in India
Date | Place | Nature of the event | Economic losses (in billion USD) | Insured losses | Number of fatalities | Number of affected persons
May 2020 | West Bengal | Hurricane Amphan | 13.5 | ND | 103 | 500 000 homeless
August 2018 | Kerala | Floods | 3.52 | 0.37 | 504 | 223 139 homeless
November 2015 | Chennai (Tamil Nadu) | Floods | 2.37 | 0.98 | 289 | -
April 2015 | Himalaya | Storm | - | - | 78 | 20 000 injured
October 2014 | Andhra Pradesh | Storm | 7.56 | 0.68 | 68 | 43 injured
September 2014 | Jammu and Kashmir | Floods | 6.45 | 0.26 | 665 | -
June 2013 | Uttarranchal | Floods | 1.21 | 0.55 | 5 748 | 4 473 injured 271 931 homeless
September 2009 | Andhra Pradesh | Floods | 5.63 | 0.06 | 300 | 2 000 000 homeless
August 2006 | Gujarat | Floods | 4.3 | 0.52 | 350 | 4 000 000 homeless
July 2005 | Maharashtra | Floods | 4.36 | 0.93 | 1 150 | 15 000 homeless
January 2001 | Gujarat | Earthquake | 6.13 | 0.14 | 19 737 | 166 850 injured 1 790 000 homeless
Source: Swiss Re
India, the second most popula
the world, is highly exposed to
disasters. Due to its geographi
seismic risk zone and intertropical convergence point, the Indian subcontinent also faces recurring atmospheric phenomena: heavy monsoon rains, floods, episodes of high heat, drought, etc.
It is the third country in the world in terms of the number of natural disasters, behind China and the United States.
The number of human casualties continues to rise, from 1 674 deaths in 2015 to 2045 in 2019.
India had reported 321 catastrophic events between 2000 and 2019 and died 79 732 (UNDRR). And India has suffered nearly 80 billion USD in economic losses in 20 years.
Geography SP...


Kerala :
• Kerala, with a population of over 3.3 crore, ranks first among Indian states on HDI.
• Kerala are at par with those of developed countries.
• In 2015–16, top five in Indian states in terms of per capita state domestic product and growth in per capita income.
• Literacy rate in 2011 of 94% (national average of 73%),
• life expectancy at birth between 2011–15 of 75.2 years (highest, & national average of 68.8 years),
• IMR of 10 per thousand live births (lowest in Indian states).
• Lowest population BPL line (7%) (national average of 22%)
• In 2015–16, 94% of households had access to improved drinking water sources,
• 98% of them were using improved sanitation facilities,
• and 99% of the households had electricity.
• Kerala is placed first in inequality adjusted HDI which indicates the least loss of HDI on account on inequality.
• In June and August, 2018, Kerala exper
ever floods in its history since 1924. Du
state received cumulative rainfall that was 42% in excess of the normal average. (during 1-20 August, when the state received 771mm of rain.)
• It triggered several landslides and forced the release of excess water from 37 dams across the state, aggravating the flood impact. Nearly 341 landslides were reported from 10 districts. Idukki, ravaged by 143 landslides.
• 1,259 out of 1,664 villages spread across its 14 districts were affected. The seven worst hit districts were Alappuzha, Ernakulam, Idukki, Kottayam, Pathanamthitha, Thrissur, and Wayanad, where the whole district was notified as flood affected.
• The devastating floods and landslides affected 5.4 million people, displaced 1.4 million people, and took 433 lives (22 May–29 August 2018).
Geography SP...

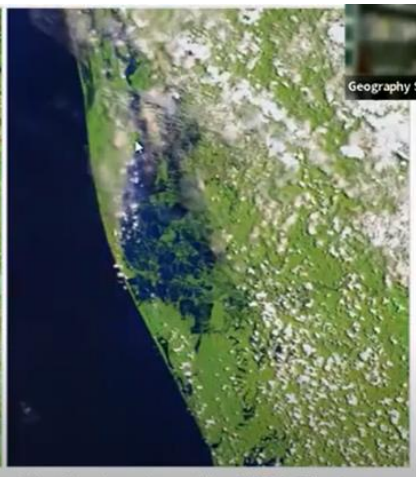
Cumulative rainfall by district [edit]

Percentage increase in rainfall compared to normal.

(1 June 2018 – 17 August 2018)[163][164]

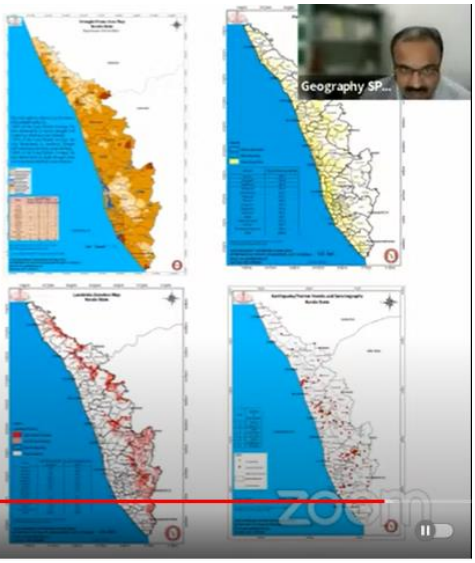
District	Rainfall (mm)	Normal (mm)	% increase
Alappuzha	1648.1	1309.5	20.54%
Ernakulam	2305.9	1606.0	43.58%
Idukki	3211.1	1749.1	83.58%
Kannur	2450.9	2234.9	9.66%
Kasaragod	2549.94	2489.1	-2.44%
Kollam	1427.3	985.4	44.84%
Kottayam	2137.6	1452.6	32.04%
Kozhikode	2796.4	2156.5	22.80%
Malappuram	2529.8	1687.3	49.93%
Palakkad	2135.0	1254.2	70.22%
Pathanamthitta	1762.7	1287.5	36.90%
Thiruvananthapuram	920.8	643.0	43.07%
Thrissur	1894.5	1738.2	8.99%
Wayanad	2676.8	2167.2	23.51%
Kerala	**2226.4**	**1620.0**	**37.43%**

https://en.wikipedia.org/wiki/2018_Kerala_floods

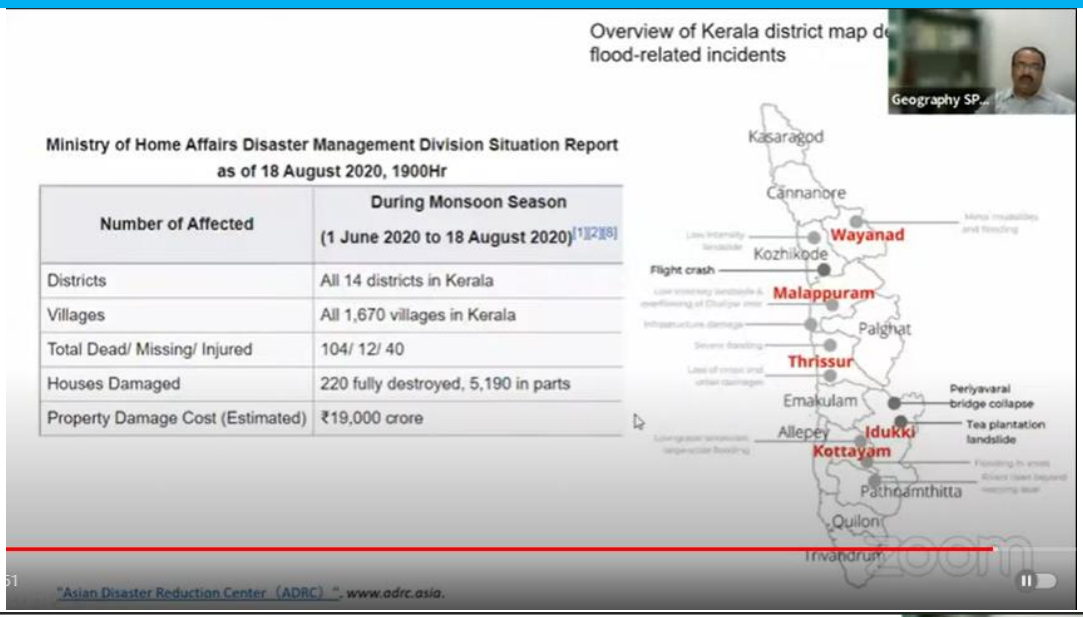


Kerala before (left/above) and after (right/below) the floods, released by NASA. The images are false-color, which makes flood water appear dark blue and vegetation bright green.

- It is highly vulnerable to natural disasters and the changing climatic dynamics given its location along the sea coast and with a steep gradient along the slopes of the Western Ghats.
- 39 hazards categorised as naturally triggered hazards (natural hazards) and anthropogenically triggered hazards (anthropogenic hazards).
- Kerala is also one of the most densely populated Indian states (860) persons per square kilometres) making it more vulnerable to damages and losses on account of disasters.
- Nearly 14.5% of the state's land area is prone to floods, and as high as 50% for certain districts.
- Landslides are a major hazard along the Western Ghats in Wayanad, Kozhikode, Idukki, and Kottayam districts.
- Seasonal drought-like conditions are also common during the summer months. Dry rivers and lowering water tables in summer have led to water scarcity both in urban and rural areas.
- Other major natural hazards are lightning, forest fires, soil piping, coastal erosion, and high wind speed. The state also lies in seismic zone III.



Overview of Kerala district map d
flood-related incidents



Ministry of Home Affairs Disaster Management Division Situation Report
as of 18 August 2020, 1900Hr

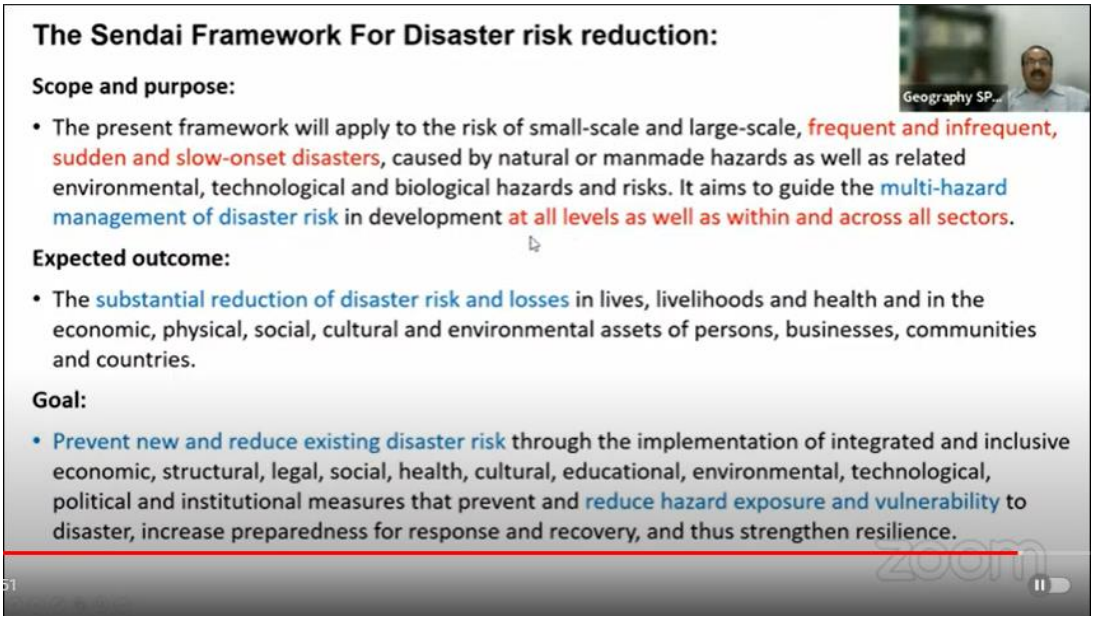
Number of Affected	During Monsoon Season (1 June 2020 to 18 August 2020)[1][2][8]
Districts	All 14 districts in Kerala
Villages	All 1,670 villages in Kerala
Total Dead/ Missing/ Injured	104/ 12/ 40
Houses Damaged	220 fully destroyed, 5,190 in parts
Property Damage Cost (Estimated)	₹19,000 crore

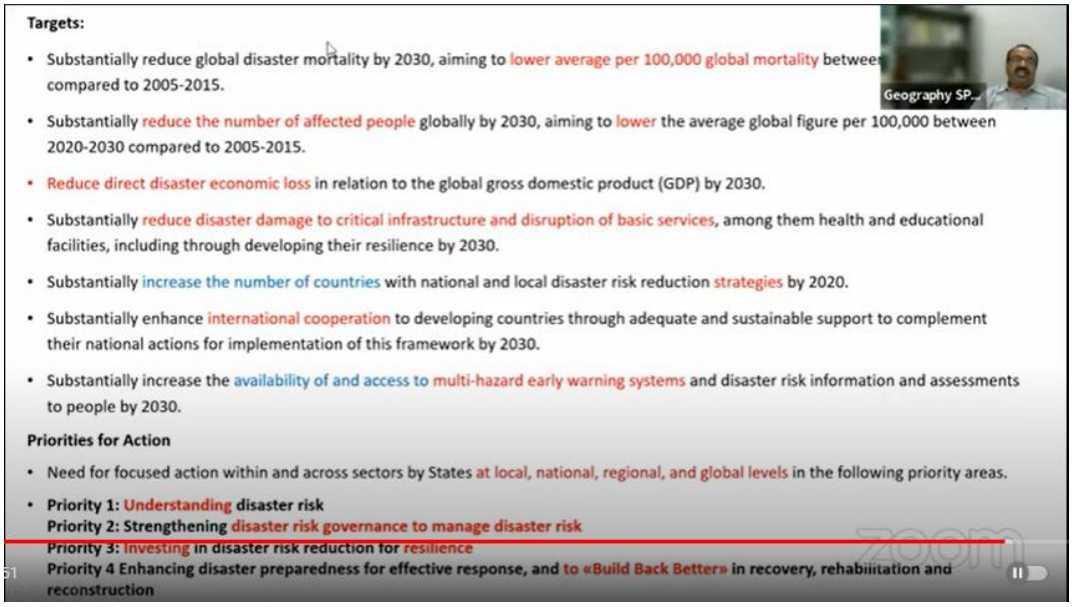
"Asian Disaster Reduction Center (ADRC)". www.adrc.asia.

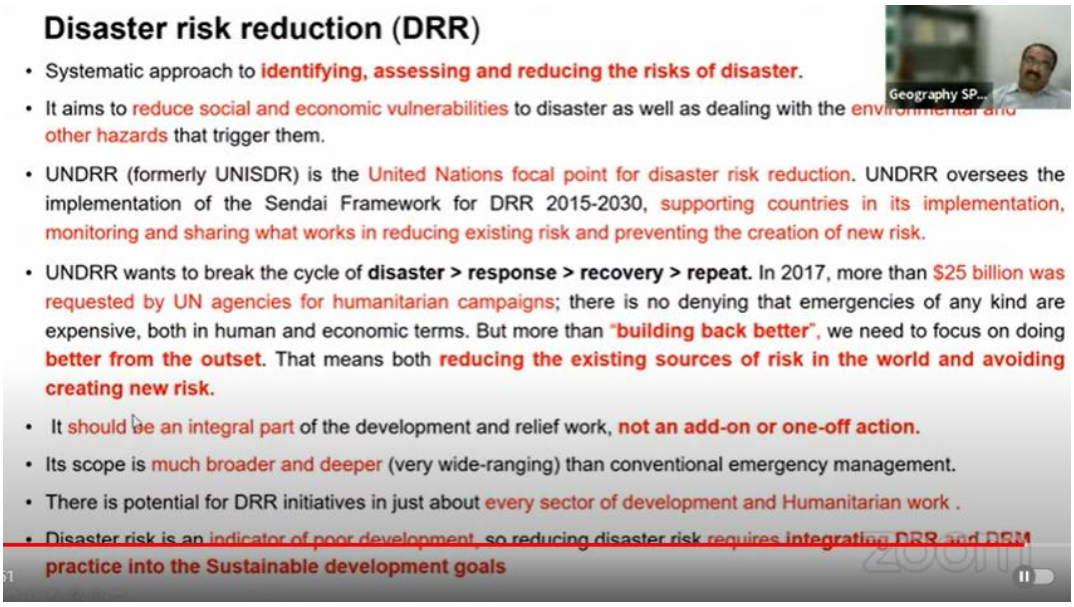
UNDP APPROACH

- Besides the estimation of potential losses and their impact, risk assessment allows for the determination of the acceptable level of risk, defined as the level of losses that is acceptable without destroying lives, national economy or personal finances.
- Once the current and acceptable levels of risk are determined, disaster risk reduction plans and strategies could be revised or developed so that they have the measurable goal of reducing the current risk to acceptable levels.
- For countering existing disaster risk systematically, for example by formulating a comprehensive DRR policy, developing land-use plans or putting in place insurance mechanisms to transfer non-reducible risks, the knowledge and understanding provided by a comprehensive risk assessment are fundamental.
- Furthermore, when the plans are being implemented, periodic evaluations of risk provide an explicit indication of progress in risk reduction. They help to evaluate the effectiveness of disaster risk reduction efforts and make the necessary corrections to the plans and strategies.

- The Hyogo Framework for Action (HFA) was the global blueprint for disaster risk re between 2005 and 2015. The HFA was adopted in 2005 at the World Conference or Reduction, held in Kobe, Hyogo, Japan.
- Its goal was to substantially reduce disaster losses by 2015 - in lives, and in the social, economic, and environmental assets of communities and countries.
- **The HFA identified priorities for action:**
- Ensure that disaster risk reduction (DRR) is a national and a local priority with a strong institutional basis for implementation
- The HFA drove significant progress in developing international co-operations, institutions, policies, and legislation for disaster risk reduction. Stakeholders at all levels, strengthened their capacities for risk assessment and identification, disaster preparedness, response and early warning.
- They concluded that the focus of national and international attention must shift from protecting social and economic development against external shocks, to transforming growth and development to manage risks, in a holistic manner.


The Sendai Framework For Disaster risk reduction:
Scope and purpose:
• The present framework will apply to the risk of small-scale and large-scale, frequent and infrequent, sudden and slow-onset disasters, caused by natural or manmade hazards as well as related environmental, technological and biological hazards and risks. It aims to guide the multi-hazard management of disaster risk in development at all levels as well as within and across all sectors.
Expected outcome:
• The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries.
Goal:
• Prevent new and reduce existing disaster risk through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience.
Geography SP...


Targets:
• Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality betwee
compared to 2005-2015.
• Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 between 2020-2030 compared to 2005-2015.
• Reduce direct disaster economic loss in relation to the global gross domestic product (GDP) by 2030.
• Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030.
• Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020.
• Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this framework by 2030.
• Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030.
Priorities for Action
• Need for focused action within and across sectors by States at local, national, regional, and global levels in the following priority areas.
• Priority 1: Understanding disaster risk
Priority 2: Strengthening disaster risk governance to manage disaster risk
Priority 3: Investing in disaster risk reduction for resilience
Priority 4 Enhancing disaster preparedness for effective response, and to «Build Back Better» in recovery, rehabilitation and reconstruction
Geography SP...


Disaster risk reduction (DRR)
• Systematic approach to identifying, assessing and reducing the risks of disaster.
• It aims to reduce social and economic vulnerabilities to disaster as well as dealing with the environmental and other hazards that trigger them.
• UNDRR (formerly UNISDR) is the United Nations focal point for disaster risk reduction. UNDRR oversees the implementation of the Sendai Framework for DRR 2015-2030, supporting countries in its implementation, monitoring and sharing what works in reducing existing risk and preventing the creation of new risk.
• UNDRR wants to break the cycle of disaster > response > recovery > repeat. In 2017, more than $25 billion was requested by UN agencies for humanitarian campaigns; there is no denying that emergencies of any kind are expensive, both in human and economic terms. But more than "building back better", we need to focus on doing better from the outset. That means both reducing the existing sources of risk in the world and avoiding creating new risk.
• It should be an integral part of the development and relief work, not an add-on or one-off action.
• Its scope is much broader and deeper (very wide-ranging) than conventional emergency management.
• There is potential for DRR initiatives in just about every sector of development and Humanitarian work .
• Disaster risk is an indicator of poor development, so reducing disaster risk requires integrating DRR and DRM practice into the Sustainable development goals
Geography SP...

Change in Approach:

- The change in thinking and practice since the 1970s
- It has wider and deeper understanding of why disasters happen.
- It is more integrated, holistic approaches to reduce their impact on society through reducing risk before it occurs.
- As well as managing impacts when disasters occur.
- It is generally understood to mean the broad development and application of policies, strategies and practices to minimise vulnerabilities and disaster risks throughout society.
- **A shift from the traditional emphasis on disaster response to disaster reduction, by seeking to promote a "culture of prevention"**
- The term **'disaster risk management' (DRM)** is often used in the same context.
- It is more properly applied to the operational aspects of DRR: the practical implementation of DRR initiatives.

Way Forward:

- The Committed leadership
- Iindigenous knowledge
- Role of NGO
- Involving multiple service providers, in an area where a strong public-private partnership is of prime importance,
- convergence of schemes must be considered for a holistic approach. Cohesion with schemes under ministries beyond tourism, for instance, rural development, culture, environment and tribal welfare,
- Participation of village panchayat
- adaptive paradigm capable of addressing widely different situations, and articulating different goals in terms of the utilization of natural resources.

We need to manage risks, not just disasters
To Achieve SDG's

Union of Geographic Information Technologists (UGIT)

Department of Geography and Geoinformatics

Bangalore University, Bengaluru - 560056