International Journal of Geography, Geology and Environment

P-ISSN: 2706-7483
E-ISSN: 2706-7491
IJGGE 2024; 6(2): 106-111
www.geojournal.net
Received: 06-08-2024
Accepted: 11-09-2024

M Vijay
Director, Centre for Disaster Management, Faculty of Engineering and Technology, Annamalai University, Annamalainagar, Tamil Nadu, India

Corresponding Author:
M Vijay
Director, Centre for Disaster Management, Faculty of Engineering and Technology, Annamalai University, Annamalainagar, Tamil Nadu, India

Efficient disaster management system: A key to sustainable development of a nation

M Vijay

Abstract
Every year some countries were worstly affected due to natural disasters which have made that country economically weaker in position. Effective disaster management is the only solution and also very important to save lives and livelihoods of people, reducing property damage and resilient operations. Appropriate measures should be followed to develop good disaster preparedness and disaster preventive measures. To have a efficient system, the following measures should be given prime importance that includes (1) Capacity Building and Community Empowerment against Disasters (2) Enhancement of Infrastructures and Adequate Facilities during Disaster (3) Effective Post Disaster Management (4) Imparting Disaster Knowledge to Student Community through Education. The present study enumerates the importance of effective disaster management system towards sustainable development of a nation and developing country like India is taken for discussion.

Keywords: Capacity building, vulnerable, global warming, community empowerment, post disaster

Introduction
India has been vulnerable to natural disasters due to its unique geo-climatic conditions. Natural disasters not only adversely affect the human and physical capital but also pose a serious threat to India's economic development. Moreover, frequent disasters also increase the fiscal pressure on the Centre and State government, besides impacting the social and economic conditions of the people. Natural disasters also increase farmer distress and are responsible for farmer suicides to a great extent. In order to save property, infrastructure, livestock, agriculture, etc., from intense damage caused by cyclones and other disasters, India needs to invest in disaster management techniques and design policies. According to the latest scientific reports, the warming of the climate will only result in an increase in the frequency and intensity of such super cyclones, thus making a well - planned management strategy the need of the hour [1]. The occurrence of natural and man-made disasters, disaster management procures the most useful data for decision-making in the most cost-effective and practical manner and protection of all communities, regions and nations from disasters. In the absence of disaster management low vulnerable natural event may turn into a human and economic disaster. The long-term consequences of a disaster alter the ecosystem that can lead to more deaths over the next few years by giving rise to certain diseases and ailments. They may also hinder tree growth or stop cultivation in a particular area, almost instantly. Many Indian States have limited resources and lack in their own disaster management plans [2]. Considering these problems, this paper attempts to throw light on a more integrated and responsive disaster management system in India.

Adverse effects of disaster on nation development
Environmental issues and consequences
Global warming is an ongoing environmental disaster and human activities including the fossil fuel burning, deforestation, and livestock farming have steadily increased the concentration of greenhouse gases in the atmosphere and raised the planet's overall temperature. Many wildfires are caused in part by global warming. Environmental issues are one of the primary causes of disease, health issues and long-term livelihood impact for India. According to data collected and environmental assessments studied by World Bank experts, between 1995 through 2010, India has made some attempts in improving its environmental quality but pollution still remains a major challenge and opportunity for the country [3]. Major environmental issues are resource depletion (such as water, mineral, forest, sand, and

rocks), environmental degradation, loss of biodiversity, loss of resilience in ecosystems, livelihood security for the poor [4, 5]. The major sources of pollution in India include the rapid burning of fuel wood and biomass such as dried waste from livestock as the primary source of energy, lack of waste removal services and sewage treatment operations, highly polluting public transport system and government-owned high emission plants [6, 7, 8, 9]. Increased urbanization and population growth in India adds pressure to environmental issues and its resources. The buildup of heavy metals in the soil of the city of Ghaziabad and these metals are being ingested through contaminated vegetables that will act as carcinogenic agents [10, 11, 12].

Contamination of water

Effluents from industry and agriculture wastes including fertilizers and pesticides were not properly treated and directly discharged into nearby water sources are a major cause for water contamination. Moreover, India lacks sufficient treatment capacity of sewage treatment plants and most of the government-owned sewage treatment plants remain closed most of the time due to improper design and poor maintenance. Accumulation of waste in urban areas results in unhygienic conditions thus contaminating both surface and groundwater [13]. WHO reported that over 100 Indian cities were directly dumping untreated waste into the Ganges River [14]. According to Central Pollution Control Board in the year 2005, India generates 29,000 million litres per day of sewage but the treatment capacity was 6000 million litres per day [15]. Flooding further worsens India's water contamination problem, as it washes and moves all sorts of solid garbage and contaminated soils into its rivers and wetlands [16].

Contamination of air

Asian brown cloud occurs mainly due to biomass burning, fuel adulteration, vehicle emission, and traffic congestion which results in delay of monsoon season in India. Traditional fuel like fuel wood, crop residue and cow dung cake dominates domestic energy use in rural India and account for about 90% of the total. In urban areas, traditional fuel constitutes about 24% of the total air pollution [17, 18, 19, 20, 21, 22]. Environmental Performance Index ranked India at 177th position out of 180 countries in 2018, as having the poorest relative air quality out of 132countries. In 2020, India is 21 out of the world's 30 most polluted cities [23, 24].

Solid waste generation

Indian cities generates more than 100 million tons of solid waste a year because public places and sidewalks are despoiled with filth and litter, rivers and canals act as garbage dumps. The tourism regions in the country mainly hill stations are also facing this issue in the recent years. In 2000, India's Supreme Court directed all Indian cities to implement a comprehensive waste-management programme that would include household collection of segregated waste, recycling and composting but no major city implemented any comprehensive programme envisioned by the Supreme Court. Even medical wastes are routinely dumped with regular municipal garbage inspite of stringent rules that require hospitals to operate incinerators. They have become significant sources of greenhouse emissions and breeding sites for disease vectors such as flies, mosquitoes, cockroaches, rats, and other pests [25].

Noise disturbance to public

Poor urban planning may give rise to noise disturbances, since side-by-side industrial and residential buildings can result in noise pollution in the residential areas. Indoor noise can be caused by machines, building activities, and music performances, especially in some workplaces. High noise levels can result in cardiovascular effects and an increased incidence of coronary artery disease. In animals, noise can increase the risk of death by altering predator or prey detection and avoidance, interfere with reproduction and navigation, and contribute to permanent hearing loss. The Supreme Court of India gave a significant verdict on noise pollution in 2005[26] and in January 2010, Government of India published norms of permissible noise levels [27].

Soil erosion

In March 2009, it was alleged to be caused by fly ash ponds of thermal power stations that lead to severe birth defects in children in the Faridkot and Bhatinda districts of Punjab. The news reports claimed the uranium levels were more than 60 times the maximum safe limit [28][29]. In 2012, the Government of India confirmed that the ground water in Malwa belt of Punjab has uranium metal that is 50% above the trace limits set by the United Nations' World Health Organization [30]. Scientific studies, based on over 1000 samples from various sampling points, could not trace the source to fly ash and any sources from thermal power plants or industry as originally alleged.

Impact of global warming on environment

Carbon market in India

India was the third largest emitter of carbon dioxide after China and United States. Carbon market in India was introduced through Energy Conservation (Amendment) Bill, 2022 to follow United Nations Climate Change Conference (COP26) as an attempt to reduce fossil fuel consumption through use of non-fossil sources such as green hydrogen, green ammonia, biomass, and bioethanol as energy and feedstock. The Indian National Carbon Trading Scheme is a carbon emission trading scheme being developed by the Bureau of Energy Efficiency in India, which may expected to start trading existing Renewable Energy Certificates (REC) and Energy Savings Certificates (ESC) by 2025 and was legislated in 2022 [31, 32, 33, 34]. The government of India established a carbon market in India, improved the Code for Energy Conservation Building and helped to build the governing council of the Bureau of Energy Efficiency through increasing members [35, 36]. The bill aimed to make the use of non-fossil fuel sources mandatory for energy and encourage feed stocks like green ammonia, green hydrogen, ethanol and biomass [37]. The mechanism of the carbon market in India can face challenges of corruption and environmental concerns [38, 39].

Change in meteorological conditions

Temperatures in India have risen by 0.7 °C (1.3 °F) between 1901 and 2018, thereby changing the climate in India [40]. In May 2022 severe heat wave was recorded in Pakistan and India. The temperature reached 51 °C. Climate change makes such heat waves 100 times more likely. Now they are expected to occur every 3 years [41]. Around the end of the century, most parts of India will likely face more and more severe droughts. Severe landslides and floods are projected to become increasingly common in such states as Assam [42].

North eastern states in India are concerned that rising sea levels will submerge much of Bangladesh and spawn a refugee crisis. If severe climate changes occur, Bangladesh and parts of India that border will lose vast tracts of coastal land [43]. Thousands of people have been displaced by ongoing sea level rises that have submerged low-lying islands in the Sundarbans [44]. Temperature rises on the Tibetan Plateau are causing Himalayan glaciers to retreat, threatening the flow rate of the Ganga, Brahmaputra, Yamuna, and other major rivers; the livelihoods of hundreds of thousands of farmers depend on these rivers [45]. Coral bleaching event occurred in 1998, destroyed more than 70% of corals in the reef ecosystems in Lakshadweep and Andaman islands due to elevated ocean temperatures and continued to become increasingly common [46, 47].

Impact of heat waves on public health

Heat waves are increasing in India because of climate change. In 2019, the temperature reached 50.6 degrees Celsius, 36 people were killed. The high temperatures are expected to impact 23 states in 2019, up from nine in 2015 and 19 in 2018. The capital New Delhi broke its all-time record with a high of 48 degrees Celsius [48, 49, 50, 51]. Heat waves also affect farm labour productivity. In 2016, for the first time in history, Kerala reported a heat wave. The government is being advised by the Indian Institute of Tropical Meteorology in predicting and mitigating heat waves. The government of Andhra Pradesh, for instance, is creating a Heat Wave Action Plan [52]. Officials say this is because the government has made an effort to reduce the death toll by encouraging residents to reduce or alter the time spent working on hot days and by providing free drinking water to hard-hit populations. It also used water to cool streets and forced police to guard water tankers in the state of Madhya Pradesh. Those measures cost a lot of money and water, and the government's resources were limited in 2019 by the country's national election. The heat wave may continue, as monsoon rains have been delayed this year [53].

Impact on agriculture

Climate Change in India will have a disproportionate impact on the more than 400 million that makeup India's poor community. This is because so many factors depend on natural resources for their food, shelter and income. More than 56% of people in India work in agriculture, while many others earn their living in coastal areas.[54] National Innovations in Climate Resilient Agriculture (NICRA) investigated the impact of climate change on Indian agriculture indicated that rainfed rice yields in India are expected to experience a marginal reduction of less than 2.5% in the years 2050 and 2080. On the other hand, irrigated rice yields are projected to decline by 7% in 2050 and 10% in 2080 scenarios. Moreover, the investigation forecasts a decrease in wheat yield ranging from 6% to 25% in the year 2100, while maize yields are estimated to decrease by 18% to 23% during the same period [55].

Effective disaster management system

Need of the hour

Disasters tend to have a physical, mental and economical impact on people and country. Natural disasters results with the pain of loss of life as well as economic hardships. Rising rate of negative changes in the climate system will increase the chance of disasters, influences of that are in maximum instances irreversible and detrimental. Disasters destroy various assets of businesses and they tend to impact market trade and buying power of consumers as well. After getting hit by a natural disaster, it takes months for a business to return to its normal functioning as they have to wait for insurance claims and for its cash flow to return to normal. Weather related disasters are a huge risk for agriculture, food and water supply. World Bank in its report stated that climate change can push 100 million people below the poverty line over the next fifteen years. Moreover, Indian climate is the most unpredictable one with a wide range of geographical area and varied topography.

Significance of effective disaster management

Vulnerability, adapting and mitigating capacities are strongly influenced by various characteristics of local communities such as livelihoods, lifestyles and cultures. Adapting to vulnerabilities can contribute to community well-being by ensuring community security. So disaster management is essential because millions of people are affected by disasters every year. In order to have an effective disaster management the following measures should be implemented that leads to sustainable growth of a nation.

Capacity building and community empowerment against disasters

A major challenge in disaster management in India is the lack of preparedness and awareness among people and authorities. Though India is a disaster-prone country, many people are ill-prepared and do not know what to do during disaster and authorities are often not adequately trained to handle disasters. This lack of preparedness often leads to confusion and delays in providing assistance to those affected. To address this challenge, there is a need to raise awareness about disasters and how to respond to them. Authorities should invest in disaster preparedness training programs, including drills and simulations, to prepare people and authorities for potential disasters. Since the language became a barrier between Indian states, disaster and their mitigation measures should be explained to them in local languages. It has been proved that countries where the communities are aware and participate in Disaster Risk Reduction (DRR) activities, the damages were minimized. Participation of communities is important pillars and support to handle the catastrophes by providing help and relief to the victims because communities know their areas better and they have indigenous methods to cope with emergencies. Therefore, it is important to build capacities of people by creating awareness and imparting them skill and training for relief and rescue operations to manage the disasters.

Enhancement of infrastructures and adequate facilities during disasters

India’s increased population density and urbanization increases vulnerability to disasters. It also makes very difficult to evacuate and provide timely assistance to all people those got affected in disaster. In an overpopulated environment, the numbers of people might be more than the available essential materials for survival such as transport, water, shelter, food or social amenities. Necessary actions should take to build resilient cities with proper infrastructure

and facilities to withstand disasters. Additional measures should be taken to reduce population density in vulnerable disaster-prone areas. So, there is a need for better infrastructure planning and investment in creating better communication networks and transportation facilities, so that critical services are not disrupted during an emergency. There is a need for increased funding for disaster management to reduce the shortage of essential supplies such as food, water, and medical aid during disasters.

Effective post disaster management

Disasters have the tendency to disrupt a person's normal life patterns. It can be distinguished from psychological stress which is defined as a serious and problematic emotional, cognitive, physical or interpersonal reaction to difficulties. Psychological effects of the disaster are as follows:

1. **Emotional effects:** Shock, terror, irritability, blame, anger, guilt, grief or sadness, emotional, numbing, helplessness, loss of pleasure derived from familiar activities, difficulty feeling happy, difficulty feeling loved.
2. **Cognitive effects:** Impaired concentration, impaired decision-making ability, memory impairment, disbelief, confusion, nightmares, decreased self-esteem, decreased self-efficacy, self-blame, intrusive thoughts, memories, dissociation (e.g., tunnel vision, dreamlike or 'spacey' feeling).
3. **Physical effects:** Fatigue, exhaustion, insomnia, cardiovascular strain, startle response, hyperarousal, increased physical pain, reduced immune response, headaches, gastrointestinal upset, decreased appetite, decreased libido, vulnerability to illness.
4. **Interpersonal effects:** Increased relational conflict, social withdrawal, reduced relational intimacy, alienation, impaired work performance, decreased satisfaction, distrust, externalization of blame, externalization of vulnerability, feeling abandoned.

Mental health and psychosocial support is not awarded high priority initially when compared to health services but governments of the affected countries soon realized that this is also a important factor needed by the people. It was recognized that any neglect of psychosocial support could impair efforts toward physical rehabilitation. As per WHO recommendation, a strong community mental health system should be developed which would serve the immediate as well as long-term needs of the community, provided it was sustainable and could become a part of the routine health care delivery system. Different countries have developed innovative methods of providing community mental health services. These efforts should be encouraged. At the same time, the impact of these services should be objectively assessed and changes made as necessary.

Imparting disaster knowledge to student community through education

In India at present there was a poor contribution of educational institutions towards imparting knowledge about disasters to student community in schools and colleges. Educational institutions should invest in public awareness campaigns to educate people about the risks associated with disasters and preventive measures they can take to prepare for them. Schools have a strategic role in educating and providing disaster mitigation knowledge starting from high school to higher education. Disaster mitigation learning is expected to increase the level of preparedness of students to natural disasters that can occur at any time. Students have a role as a source of knowledge and disseminate disaster knowledge to nearby neighborhoods and also they will care for the condition of the community from any natural disaster events that occur effectively and efficiently. Also, can influence cognitive elements and shape how individuals view and assess the risks of disasters, and how they process information to minimize the risk of disaster. Preparedness measures are closely related to how individuals view and act on the knowledge of disasters gained, educated individuals are more aware of disaster risk, as they tend to have greater access to sources of information and are better able to select risk knowledge [57].

Conclusion

Damage caused by disasters resulted in

1. Loss of capital assets and infrastructure such as housing, schools, factories and equipment, roads, dams, bridges etc.
2. Loss of life and livelihood
3. Outbreak of infectious disease, acts of terrorism can all lead to large-scale economic losses for a country.

UN Member States adopted the Sendai Framework for Disaster Risk Reduction 2015-2030, the global plan to reduce disaster losses, which is fundamental to the success of the 2030 Agenda for Sustainable Development. In 2018, the focus is on target to reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030. In order to have effective disaster management, organizing various community based development programmes, awareness camps, training sessions and enhancing the ability to prepare and recover people successfully from adverse events will minimize the economic impacts and can lead to sustainable development.

References

1. Gogia V, Dabir A, Mundra D, Aneja T. The impact of natural disasters on development of India. Int J Socio-Econ Environ Outlook, 2022 Nov, 9(11). DOI: 10.36713/epra0314.
2. Substance Abuse and Mental Health Services Administration. An official website of the United States government; c2017. Available from: www.samhsa.gov/sites/default/files/dtac/srb-low-ses_2.pdf
3. The World Bank. The Little Green Data Book. Washington (DC): The World Bank Publications; c2010. ISBN-13: 978-0821382455.
4. Ravi DR. Environmental issues, law and technology: An Indian perspective. Delhi: Research India Publication; c2009. ISBN: 978-81-904362-5-0.
5. Kandlikar M, Ramachandran G. India: The causes and consequences of particulate air pollution in urban India: A synthesis of the science. Annu Rev Energy Environ. 2000;25:629-684. DOI:10.1146/Annurev.Energy.25.1.629.
6. Kapur A. Drowning in a sea of garbage. Int Herald Trib; c2010.
7. Karthik S, Tripathi A, Mishra RK, Bouskill N, Broadaway SC, Pyle BH, *et al*. The role of water use patterns and sewage pollution in incidence of water-borne/enteric diseases along the Ganges River in

Varanasi, India. Int J Environ Health Res. 2006;16(2):113-132.
DOI: 10.1080/09603120500538226.
8. Tockner K, Stanford JA. Riverine flood plains: present state and future trends. Environ Conserv. 2002;29(3):308-330.
DOI: 10.1017/S037689290200022X.
9. Sushil, Batra B. Analysis of fly ash heavy metal content and disposal in three thermal power plants in India. Fuel. 2006;85(17-18):2676-2679.
DOI: 10.1016/j.fuel.2006.04.031.
10. European External Action Service. India: Country strategy paper, 2007-2013; c2007.
11. Chabukdhara M, Munjal A, Nema AK, Gupta SK, Kaushal RK. Heavy metal contamination in vegetables grown around peri-urban and urban-industrial clusters in Ghaziabad, India. Hum Ecol. Risk Assess. 2016;22(3):736-752.
DOI: 10.1080/10807039.2015.1105723.
12. Chabukdhara M, Nema AK. Heavy metals assessment in urban soil around industrial clusters in Ghaziabad, India: Probabilistic health risk approach. Ecotoxicol Environ Saf. 2013;87:57-64.
DOI: 10.1016/j.ecoenv.2012.08.032.
13. Central Pollution Control Board, Ministry of Environment & Forests. Evaluation of operation and maintenance of sewage treatment plants in India-2007; c2008.
14. National Geographic Society. Water: A story of hope. Washington (DC); c1995.
15. Central Pollution Control Board, Ministry of Environment & Forests. Status of sewage treatment in India; c2005.
16. Indian Express. Buddha Nullah the toxic vein of Malwa; c2008 May 21.
17. United Nations Environmental Programme. The Asian Brown Cloud: Climate and other environmental impacts; c2002.
18. The World Bank. Urban air pollution, catching gasoline and diesel adulteration; c2002.
19. India Today. Gridlocked Delhi: Six years of career lost in traffic jams; c2010 Sep 5.
20. Indian Council of Medical Research. Indoor air pollution in India - A major environmental and public health concern; c2001.
21. World Health Organization. Biomass pollution basics. Archived from the original on 2012 Jul 9.
22. Smith KR, Uma R, Kishore VV, Zhang J, Joshi V, Khalil MA. Greenhouse implications of household stoves: An analysis for India. Annu Rev Energy Environ. 2000;25:741-63.
DOI: 10.1146/annurev.energy.25.1.741.
23. Yale University. Data explorer: Indicator profiles - Environmental performance index; c2012.
24. Regan H. 21 of the world's 30 cities with the worst air pollution are in India. CNN; c2020 Feb 25. Retrieved 2020 Feb 26.
25. University of Oregon. India: Urbanization, sustainable development and poverty alleviation, INTL 442; c2010. Archived from the original on 2013 May 8.
26. Supreme Court of India. Justices Lahoti and Bhan. Noise pollution restricting use of loudspeakers. ECOLEX; c2005 Jul 18.
27. Ministry of Environment & Forests, Govt of India. Amendment to noise pollution regulation and control rules, 2000, setting up of a national noise monitoring network; c2010 Jan 4.
28. Yadav P. Uranium deforms kids in Faridkot. Times of India; c2009.
29. Jolly A. Punjab disability 'uranium link'. BBC News; c2009.
30. Ministry of Drinking Water and Sanitation, Govt of India. Uranium in groundwater; c2012.
31. Sirur S. Green think tank CEEW suggests EU & Korea-like 'emissions trade' for India's carbon market launch. The Print; c2023 Feb 21. Retrieved 2023 Mar 19.
32. Financial Express. The EU's carbon tax: What India must do. Retrieved 2023 Mar 19.
33. Business Line the Hindu. Carbon trading: India will be the biggest carbon market in the world by 2030; c2023 Mar 8.
34. Ramesh M. India will be the biggest carbon market in the world by 2030, says BEE. The Hindu Business Line; c2023 Mar 8. Retrieved 2023 Mar 19.
35. CNBC TV18. India to open carbon market: What is it and how will it help in the fight against climate change. 2022 Aug 14. Retrieved 2022 Aug 31.
36. Mani S. India will get carbon markets: 10 things about the Lok Sabha bill & how it affects you. The Better India; c2022 Aug 11.
37. Gogoi G. Carbon market in India is long time coming. But Modi govt can learn from these mistakes. The Print; c2022 Aug 17.
38. The Economic Times. Learning from global experience: Creating carbon markets for India; c2022. Retrieved 2022 Aug 31.
39. Financial Express. Ensuring carbon market's success; c2022 Aug 26. Retrieved 2022 Aug 31.
40. Sharma V. Average temperature over India projected to rise by 4.4 degree Celsius: Govt report on impact of climate change in country. Tribune India; c2020. Retrieved 2020 Nov 30.
41. Rowlatt J. Climate change swells odds of record India, Pakistan heatwaves. BBC; c2022. Retrieved 2022 May 20.
42. Gupta V, Jain MK. Investigation of multi-model spatiotemporal mesoscale drought projections over India under climate change scenario. J Hydrol. 2018;567:489-509. DOI:10.1016/j.jhydrol.2018.10.012.
43. Hossain M. Climate change impacts and adaptation strategies for Bangladesh. In: Climate change and growth in Asia. Edward Elgar Publishing; c2011.
44. Harrabin R. How climate change hits India's poor. BBC; c2007. Retrieved 2021 Mar 11.
45. Sethi N. Global warming: Mumbai to face the heat. Times of India. 2007. Retrieved 2021 Mar 11.
46. Normile D. Global warming: Some coral bouncing back from El Niño. Science. 2000;288(5468):941a-942. DOI:10.1126/science.288.5468.941a.
47. Aggarwal D, Lal M. Vulnerability of Indian coastline to sea level rise. Proceedings of the APN/SURVAS/LOICZ Joint Conference on Coastal Impacts of Climate Change and Adaptation in the Asia-Pacific Region; c2000.
48. Indian Express. India may lose 3-10% GDP annually by 2100 due to climate change, says report; c2021 Jun 9. Retrieved 2021 Jul 1.
49. Overseas Development Institute. The costs of climate change in India: A review of the climate-related risks

facing India and their economic and social costs; c2021. Archived from the original on 2021 Jun 8. Retrieved 2021 Jul 1.
50. Van Oldenborgh GJ, Philip S, Kew S, van Weele M, Uhe P, Otto FE, *et al*. Extreme heat in India and anthropogenic climate change. Nat Hazard Earth Syst Sci. 2018;18:365-381. DOI:10.5194/nhess-18-365-2018.
51. The Wire. 2018 was sixth warmest year in India's recorded history: IMD; c2020 Oct 30. Available from: https://thewire.in/environment/2018-was-sixth-warmest-year-in-indias-recorded-history-imd
52. Alexander U. Ecological myths, warming climates and the end of nature. The Caravan; c2019 Jul 17. Available from: https://caravanmagazine.in/perspectives/ecological-myths-warming-climates
53. Rosane O. 36 die in India heat wave, Delhi records its highest all-time temperature. Ecowatch; c2019 Jun 14. Available from: https://www.ecowatch.com/india-heat-wave-2019-2638788294.html
54. United Nations Development Programme (UNDP). India and climate change impacts; c2010. Archived from the original on 2011 Mar 17. Retrieved 2010 Feb 11.
55. Government of India, Press Information Bureau (PIB). Effect of climate change on agriculture; c2023 Jul 26. Available from: https://pib.gov.in
56. Barman A, Jha R, Rajak F. Impacts of urbanization and encroachment in urban wetlands: A case study of Ganga riparian wetlands in Patna. ResearchGate; c2021. Available from: https://www.researchgate.net/publication/348862986
57. Fauziyah ARS, Sugandi D, Ruhimat M. The role of disaster knowledge in the preparedness of students in West Bandung Regency. IOP Conf. Series: Earth Environ Sci. 2022;1089:012069. DOI:10.1088/1755-1315/1089/1/012069.