OPEN TEXT - BASED ASSESSMENT

ANNUAL EXAMINATION

2014-15

BIOLOGY (044)

Class-XI

Themes | Page

CENTRAL BOARD OF SECONDARY EDUCATION

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OPEN TEXT MATERIAL

1. Theme – *Quantifying Evidences of Sensitivity*

Abstract:

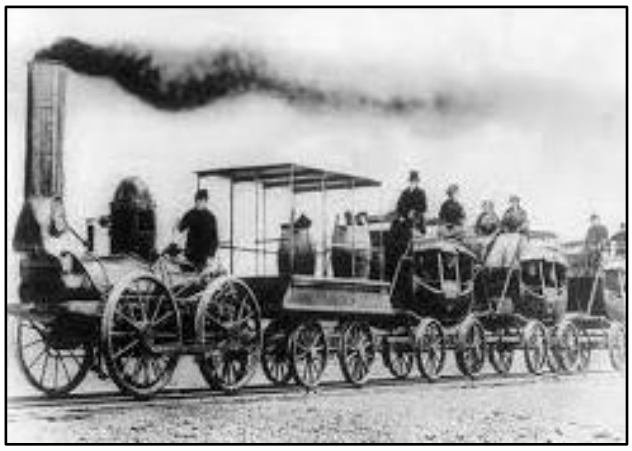
Shifting the focus from guilt and indignation generated because of deteriorating / degrading environmental quality and gearing to quantity the evidences of successful restorative efforts, positively influences the intensity of encouragement and motivation which gets reflected in the act of enactment.

Mother Nature is beautiful and bountiful. It has provided us with all possible means of sustenance and a happy and fulfilled life. It has taken care of our need for food and fresh clean water, life sustaining oxygen and beautiful companions in the form of birds, butterflies, flowers and trees.

Since ages man has lived in harmony with Mother Nature deriving benefits from its bounty and being protected from all kinds of harm. Along with it, the huge biodiversity on the earth is important for humans through ecosystem services and goods. Ecosystem services are - regulatory such as air and water purification, provisioning (goods), such as fuel and food and cultural and supporting such as pollination and nutrient cycling.

However, with the advent of the industrial revolution in about 1760 to sometime between 1820 and 1840, began an era when man broke the umbilical cord with Mother Nature and went on a path of rampant plunder of nature's beauty and bounty. Setting up of factories and mass production led to degradation of certain natural resources, leaving our environment permanently/sustainably damaged. One example of this depletion was deforestation. When the trees were cleared, the wildlife in the forest also became uprooted.

Scarcity of trees compounded the problem of carbon emissions. Forests help to emit oxygen and balance its percentage in the air, whereas factories emit poisonous emissions and eliminate the source of oxygen. The pollution that has resulted from factories involved not only in airborne emissions but in land and water pollution also and shifted the world from green house effect to global warming and climate change.



Non - sympathetic deforestation is being continued at an alarming rate since early 1950s. Almost half of the original forest habitat has been cut down. The removal of trees without replenishing with sufficient reforestation has resulted in serious damage to habitats, biodiversity and led to aridity. It has unfavorable impacts on atmospheric carbondioxide levels and has permanently destroyed the habitats of thousands of plant and animal species.

Insects like cockroaches are said to be able to survive even in a nuclear holocaust. Do you think that insects may one day replace mammals as the dominant species due to global warming and habitat loss!!!

In the rain forests and the Himalayas, for instance, many species that had yet to be discovered have been destroyed forever due to bizarre destruction of their habitats, fragmentation of the habitats and killing and poaching.

Mass extinctions have taken place on the earth earlier too and new species took the place of older ones, for example, mammals took over reptiles or angiosperms replaced ferns. However, this time unlike the mass extinction events of geographical history, current extinction challenge is one for which a single species – ours- is almost wholly responsible and will also bear the maximum brunt.

If there are 100,000,000 species on the planet and the extinction rate is just 0.01% per year, at least 10,000 species go extinct ever year.

If the approximate number of species is 1.9 million, given the present rate of extinction, how long would it be before we lose all the species in the world???

Although, it is we the humans who are almost wholly responsible for the mass extinction episode, it is our species only that is taking the maximum steps to alleviate the situation.

Thus a large number of restoration drives have taken place and are still on to restore the Earth's ecosystem to its old pristine form.

One of the best examples of ecosystem restoration can be seen in the form of Aravalli Biodiversity Park. Once a dense forest, Bhatti-Asola area on Delhi-Haryana border was ravaged by mining.

Now the area is gradually trying to come back to life due to continuous and combined efforts along with the coming back of peacocks, birds, reptiles, amphibians and other wild live stock, that were on the verge of getting extinct from the area in the upshot of large-scale mining. Approximately 5,566 acres of land in the Aravalli range of Delhi-Haryana border has been cultivated. Breeding of

reptiles has also increased along with which the area is becoming a habitat for some of the most venomous snakes and lizards, avians and amphibians. A leopard was also reported to have been spotted some time back.

13 old ponds have been converted into relatively bigger water bodies by increasing the area and about 95 percent of the land has been covered with vegetation. This has happened because the government declared the area as a wildlife sanctuary and steps were taken to rehabilitate it.


These water bodies in the area were once reduced to arid patches by continual mining, now the water bodies are healthy again


The swathes were once dense forests but were ravaged by quarrying, they are green once again

On the same lines, restoration of the coral reefs is also taken up at war footing by countries including India that have a marine ecosystem and coral reefs. Coral reefs are extremely complex marine ecosystems which provide habitat to numerous aquatic species. Coral reefs are considered to be the most biologically diverse and productive ecosystems on the earth. They occupy approximately 0.2% of the world's ocean surfaces.

How are corals made? What use are they put to?

Can they be significant enough to affect the global eco-system?

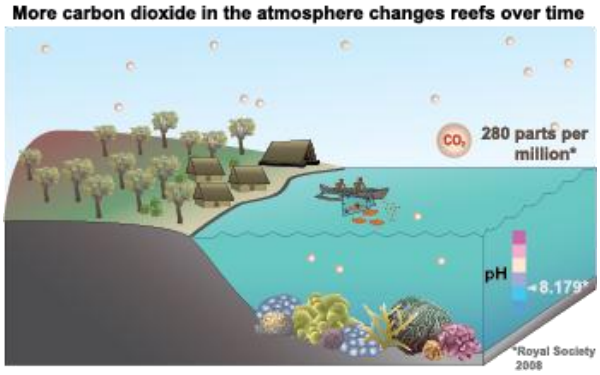
However, coral reefs around the world are declining due to human-caused changes in water quality which increases water temperature, and adversely affect the nutrients, as well as from direct physical damage from being hit by massive ships and boats, anchoring, destructive fishing techniques, and other intensifying human stresses.

If water temperature stays higher than usual for many weeks, the zooxanthellae, on which corals are dependent for food, leave their tissue. In absence of zooxanthellae, corals turn white because zooxanthellae give corals their colour. White, unhealthy corals are called bleached which are weak and less able to combat diseases.

Besides increase in temperature, ocean acidification affects other living beings too, for example, in snails, clams, and urchins; the process of making of calcium carbonate shells by absorption of calcium is being hindered.

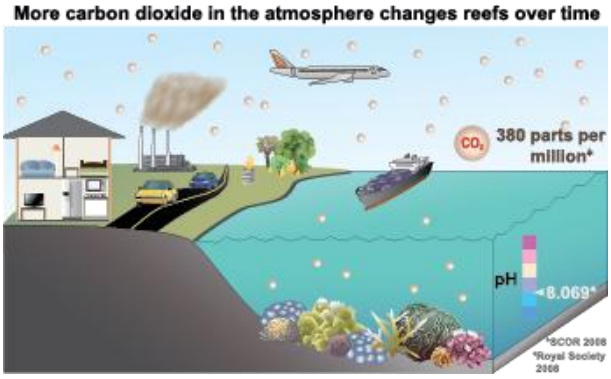
The following set of pictures show a progressive increase in the level of atmospheric CO_2 has affected the acidity of the ocean and consequently the Coral Reefs:

1.



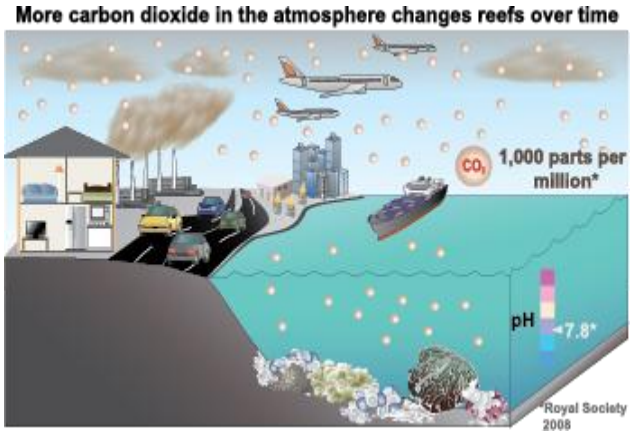
Normal level of CO_2 maintains the acidity level of the oceans

2.



Increase in the CO_2 level increases ocean acidity

3.



Excess of CO_2 in the atmosphere causes ocean water to become too acidic for the survival of corals

Which group/s of organisms do snails, clams, slugs and sea urchins belong to?

How does an increase in the atmospheric level of CO_2, change the acidity of the ocean??

Damage to coral reefs is causing severe declines in catches, stocks, sizes, and diversity of fish and other marine animals, and it also causes erosion of beaches and coastal structures, and loss of tourism revenues.

To address these issues, innovative techniques like underwater coral farming and reattachment of broken coral pieces are being used. The emphasis is on preventive aspects as the restoration work is both costly and time consuming.

The Ministry of Environment in India has established a National Coral Reef Research Centre at Port Blair. It is a two-tier system at National and State level which is in operation for efficient

coordination to implement the Scheme on Mangroves and Coral Reefs. The Ministry's task is to provide financial assistance to the State Forest Departments of all identified coral reef areas for activities like monitoring, surveillance, education and awareness. Research and development activities are also being supported with emphasis on targeted research on coral biodiversity and its management, including various aspects of pollution in these areas.

(Source: Data from Ministry of Environment & Forest)

When prevention was found to be not enough, active redressal of the damaged coral reefs was done. In U.S, special request was made to the trained scuba divers to work on the reefs. These divers transplanted the pieces of coral by using cement or epoxy putty. The goal was to restore/repair coral reefs to allow the natural inhabitants a chance to thrive. Scientists have found that the corals, which are grown in the nurseries, are able to reproduce in their new homes. It means genetic diversity can be achieved along the reefs by allowing for stronger and more resilient ecosystems in our oceans.

In August 2002, the 36-feet long boat *Lagniappe II* (a huge ship) ran aground on a shallow coral reef near Key West, Florida and injured approximately 376 square-feet of living corals coming under the sanctuary. After assessment of damage to the reef by sanctuary staff, restoration biologists discovered and used special cement that hardens under water to reattach approximately 473 corals and their fragments that had been toppled or dislodged during the grounding. The sanctuary was tracked for coral condition at the restoration site over an eight-year period, began in 2002. By 2009, the reattached coral fragments were undistinguishable from the adjacent undamaged coral colonies. Surprisingly after a year, the population of corals at the restoration site was higher than at the reference site.

Underwater coral farm

Repairing of the coral using cement and epoxy

Similar to the coral reefs, are the Mangrove forests of India. Mangroves are salt-tolerant forest ecosystems of tropical and subtropical intertidal regions and are abundant along the coasts of the Indian subcontinent. Like terrestrial tropical forests, mangroves have been a significant part of the Indian economy for thousands of years and are a reservoir of valuable natural resources.

They are multiple use ecosystems and play a role in mitigating the impact of natural disasters such as cyclone, storm surges and tsunami in coastal zones. They provide livelihood to millions of fishers and act as critical habitat for wildlife.

However, not all coastal areas are suitable for mangrove plantation as mangrove requires an appropriate mix of saline and freshwater, and soft substrate like mudflats to be able to grow and perpetuate.

Thirty eight mangrove areas have been identified in India for intensive conservation and management. The Coastal Regulation Zone Notification, 2011, recognizes the mangrove areas as ecologically sensitive which implies that these areas are accorded protection of the highest order.

FSI (Forest Survey of India) has been assessing the mangrove cover using remote sensing since 1987. The recent assessment shows that the mangrove cover is 4,662.56 km^2or 0.14% of total geographical area. The very dense mangrove comprises 1,403 km^2 (30.10%) and moderately dense mangrove 1,658.12 km^2 (35.57%), with open mangroves 1,600.44 km^2 (34.33%).

Compared with 2009 assessment, there has been a net increase of 23.34 km^2 in India's mangrove cover, attributable to increased plantations, particularly in Gujarat, and regeneration of natural mangrove areas.

(Source: Ministry of Environment & Forests Government of India, Brief Statement on Activities and Achievements 2013)

Germinating red mangrove

Pneumatophores

The indiscriminate use of the coastal wetlands causes loss of nutrients, soil erosion, and decreasing fishery potential, which in turn has led to many ecological and economic problems along the coast.

For Example, the Mahim Creek, a coastal wetland in Mumbai, considered a heavily polluted area, is under several developmental pressures including railroad lines, water pipes, bridges, industries and slums. Water, heavily contaminated with toxic industrial waste, cannot support animal life. In order to alleviate the situation for this heavily polluted area, the Mumbai Municipal Corporation and the World Wide Fund for Nature (Mumbai) jointly agreed to rehabilitate this area as a

mangrove park for habitation by diverse bird fauna. Setting up of a mangrove nursery led to mangrove afforestation in the Mahim Nature Park (MNP) possible.

Today, the Mahim Creek supports a flourishing evergreen mangrove forest. This vegetation and the surrounding areas are favourite roosting spots for aquatic and migratory birds that spend winter in the Indian subcontinent. That is why the Mahim Nature Park has become a popular spot for birdwatchers from mid October to February-March. Though the water of Mithi river is polluted, but Mahim Nature Park and surrounding mangroves provide resting spots for thousands of birds.

Restoration of Mahim Creek

The replantation of mangroves and development of the forest

The common house sparrow - *Passer domesticus* is one of the most ubiquitous birds in our surroundings and is one of the most familiar winged companions of humans. It has, during the course of evolution, evolved with us. It is the most familiar bird to us. Its chirping still awakes the people in the villages. Since we share the same habitat, it becomes our moral responsibility to save them.

This bird was continuously on the decline over its large natural range, both in the rural and urban habitats. The decline in the number of the house sparrow was a signal of continuous degradation of the environment.

March 20 is being celebrated as World Sparrow Day. The purpose behind it is not only to organize events on that day but to use it as a tool for spreading awareness among the masses about the need of the hour to protect urban biodiversity. The celebration aims at bringing together the various strata of individuals to work for the cause. It also aims at awakening scientific community and government to take its notice and implement the idea of protection and reform policies for it.

Scientists observed it in 1990s and since then surveys are being conducted to know the cause of decline in their number and advertisements, campaigns and outreach and awareness programmes are being conducted to combat the situation. The celebrations are worldwide in form of activities to protect it. Citizen Sparrow is an ongoing programme on the same lines, in India, to seek the contribution of every individual in knowing the actual and timely status of every corner of the country and a link is given where the information can be uploaded. This can be done at personal and community level wherein school children can also participate in shouldering the responsibility of being global citizen.

There are the observations and reports of expert ornithologists in journals such as Indian Birds and also on the website of Common Bird Monitoring of India (CBMI), a Citizen Science Programme of Nature Forever Society. Many organizations and individuals are part of the programme. The programme was intended to collect data on common Indian birds. Though the monitoring exercise was not as long-standing as that of CBMI, a survey done between April and July, 2012 by Citizen Sparrow has been an intense exercise in monitoring the concerned species, with 10,666 records, from 5655 participants across 8425 locations in India. This was a big initiative involving every citizen possible; the oldest participant was 91, and the youngest, 7. The findings did indicate a fall in the number of House Sparrows.

There are some more anecdotes which make us aware about the individual and communal steps taken in this direction. Students from Women's College, Patna, scattered millets for sparrows. In 2012, sparrow was declared as the state bird of Delhi and it was said that the idea behind it is to protect it. The Nature Forever Society with the Burhani Foundation (India) started a campaign named 'SOS' = Save Our Sparrow, in which they distributed 52,000 bird feeders around the world on a non-profit basis. The Postal Department of India has also contributed in spreading awareness as it released a stamp of the house sparrow on March 20, 2010.

Youth of Purunabandha village of Ganjam district got attracted towards the issue and they took up conservation attempts as their hobby. The combined and dedicated efforts started showing the results as the team started with 11 sparrows around them and reached to 50 within a year. This team has inspired the youth of surrounding villages too to find causes of vanishing of other birds including sparrows from the periphery and to root them out.

India has one more property along with many others – the big cats. Country has half of the world's tiger population. Recently tiger census report has been released on 28th March, 2011, according to which there are 1,706 tigers in the country, ranging from 1,571 to 1,875. This report was released by National Tiger Conservation Authority.

According to Tiger Census report 2008, there were 1411 tigers in all 17 tiger states of the country, classified into 6 landscapes; Central Indian Landscape Complex, Eastern Ghats, North Eastern Hills, Western Ghats, Shivalik – Gangetic plains and Sunderbans. It was threatening to know from various sources of information that 923 tigers were killed from 1994 to 2010 and it was further sad to know that this figure includes only reported cases which may be a fraction of real data. Many of the tiger population, particularly those outside protected reserves, are fragmented and suffer from intense poaching pressure, a dwindling prey base and plenty of over-used habitats.

In spite of all these problems, India holds better chances of tigers' survival and conservation with overall 17 tiger states and 7 states with tiger population more than 100.

There are many dedicated organizations in India working for it on a national level and trying to increase political will to secure the future of tigers.

Strategy for tiger conservation by NTCA and WPA 1972 included the setting up of 66 national parks and 421 wildlife sanctuaries. Later on the number was increased to 102 and 515 and further 44 conservation reserves and 4 community reserves were set up. A ban had put up on poaching and tiger trade. These efforts resulted in increase in the tiger density. Training, support and better law enforcement were the key points of protection measures. Loss of vital habitats due to urbanization, building of dams has been observed seriously and reduced a lot.

From June, 2010 to July, 2011 the National Tiger Conservation Authority (NTCA) in collaboration with the Wildlife Institute of India (WII) undertook a self-regulating Management Effectiveness Evaluation (MEE) of all 39 tiger reserves in India. The category-wise outcome of MEE Process summarized that out of all of them Jim Corbett, Bandhavgarh, Bandipur, Kanha, Mudumalai, Nagarhole, Pench (Madhya Pradesh) and Dudhwa hold excellent records in tiger population whereas, Annamalai, Bhadra, Kalakkad-Mundathurai, Dandeli-Anshi, Kaziranga, Parambikulam, Mudumalai, Periyar, Bori-Satpura and Sundarbans hold very good, Buxa, Dampa, Satkosia (Odisha), Udanti-Sitanadi, Manas, Pakke, Namdapha, Valmiki, Rajaji, Pench (Maharashtra)and Panna hold good and Indravati, Nagarjunsagar-Srisailam, Kawal, Sariska, Nameri, Sanjay-Dubri, Sahyadari have satisfactory results.

Conservationists rejoiced when the figures of number of tigers from 2011 census were released. According to the second all-India tiger population estimation study, carried out in the designated 39 tiger reserves across the country, there found an increase of 295 tigers in India. Some exhaustive studies indicate that better protected tiger source sites, especially tiger reserves, have maintained viable tiger populations, however, the area occupied by tigers outside protected areas has decreased considerably. This demonstrates the need for securing corridors for tigers to move between source sites. The existing tiger reserves represent around one-third of India's high density forest area.

Government of India has enacted Biological Diversity Act, 2002 (BDA 2002) according to which national, state and local level mechanisms have been provided for implementation of the Act. At national level, National Biodiversity Authority (NBA) was established by Government of India on 1 October 2003.

The Government aims to promote capacity building and awareness raising activities, already initiated in five Project States, namely Andhra Pradesh, Gujarat, Himachal Pradesh, Sikkim and West Bengal which assist the States in notifying threatened species in their areas of jurisdiction. So far the species which are on the verge of extinction have been notified in fifteen states and one UT (A&N Islands). The activities facilitate projects related to digitations of biodiversity-related data, design/implement the Indian Biodiversity Information System (IBIS), undertake/facilitate projects related to biodiversity conservation such as, The Economics of Ecosystems and Biodiversity (TEEB), etc.

TIMES CITY

NCR bars tourism in green zones

Board Wants Sacred Grove Mangar Bani Earmarked As No-Construction Area

Dipak Kumar Dash | TNN

New Delhi: Tourism activities won't be allowed in the Natural Conservation Zones (NCZs) in NCR, according to the minutes of recent NCR Planning Board (NCRPB) meeting. The minutes revealed that the ministry of environment and forest had specifically wanted deletion of the controversial clause allowing such activities in NCZ in the revised regional plan.

The board also decided that the sacred Mangar Bani and a 500-metre buffer radius around it will be earmarked as a "no-construction zone", as proposed by Haryana government. Sources said the core grove is around 250 hectares.

As it was reported in TOI on April 26 that the board members agreed to limit construction in NCZs such as Aravalis, riverbeds and major water bodies, the minutes recorded that only "regional recreation activities" will be permitted with "no construction exceeding 0.5%" of the area with permission from competent authorities.

SAFE FROM EXPLOITATION

Delhi government, MoEF and environment activists were objecting to Haryana's proposal to allow more construction in these sensitive zones after obtaining permission from authorities concerned. The minutes mention that MoEF secretary V Rajagopalan cited the Haryana mega-tourism policy that allows construction for both residential and commercial use to argue why "tourism" should not be allowed in the ecologically sensitive areas. Haryana chief minister Bhupinder Singh Hooda had accepted all the suggestions to make necessary amendments. However, in its letter, MoEF mentioned that both the revised regional plan and Haryana sub-regional plan should not be finalized till mapping of forest areas i members was completed. T green ministry wrote the g referenced maps of Hary na's 19 districts were "incor plete" and "not compatibl to the directions of Supre Court. He had even raised i issue of how areas with lo crown density (green co have not been shown as for Haryana has objected MoEF's parameter of ide fying forest and has sai would not accept the new teria until and unless th are approved by the Supre Court.

Delhi Government bars tourism in eco-sensitive zones

The ecosystem is like a building in which we live, removing a few bricks or planks of wood from some random places may not affect us immediately and it may seem to be of no consequence, however, when we continue to remove bricks and planks of wood from all floors of the very building in which we live and do not replace them, the consequence is anybody's guess and just a matter of time. This analogy can easily be applied to the ecosystem biodiversity. Extinction of a few species may not have affected us grossly till now but as we continue to put various species of plants and animals in the endangered list, it may affect us in ways that we have never even thought of. For example, the use of pesticides can remove pollinators from the environment and the extinction of pollinators would mean that we will have to look for some other (expensive) means of pollination, and hence for variation in plant for better adaptability and sustenance which will further increase the price of food and indirectly affect economy adversely.

From the above details it clearly emerges that our mother nature is facing an unprecedented threat. However, it also emerges that we are taking measures to overcome this situation and to make the earth a safe place for all creations.

As responsible global citizens, it is our duty to alleviate the situation while we still have the time. We know that we are on the job but modern scenario demands to expedite it.

Sample Questions

1. Establish a correlation between hierarchy of animals followed in the text and the phyla studied during regular course of study. As a responsible global citizen, critically analyze the causes and consequences of efforts taken to conserve and restore priceless Biodiversity of the Mother Planet. (5)

2. Justify your perception about the title of the text material "Quantifying evidences of sensitivity". Also justify the significance of this text material in context of modern scenario. What insight do you get out of this text material to the world outside? (5)

Marking Scheme

1. From simple to complex organisation in organisms from lower to higher groups of classification. (2)

   Analysis of Causes & Consequences with global perspective. (3)

2. Perception about the title with Justification. (2)

   Justification about the significance of text material in modern scenario (2)

   Insight about the world outside (1)

OPEN TEXT MATERIAL

2. Theme – *Environmental Sanitation*

Abstract:

"Environmental sanitation is a biggest public health issue in India. Present interventional studies on environmental sanitation in the country highlighted the significance of prioritizing control strategies. Research referred to the appropriate cost – effective intervention strategies and their result oriented implementation in Indian context is a great challenge. These strategies need to be structured according to the need of the country. This material gives an insight about the present status of sanitation, alarming situations, the efforts put in for its betterment and need of the hour."

"…..No one should spit or clean his nose on the streets. In some cases the sputum is so harmful that the germs are carried from it and they infect others with tuberculosis. At some places spitting on the road is a criminal offence. Those, who spit after chewing betel leaves and tobacco, have no consideration for the feelings of others. Spittle, mucus from the nose, etc., should also be covered with earth.

"Near the village or dwellings, there should be no ditches in which water can collect. Mosquitoes do not breed where water does not stagnate. Where there are no mosquitoes, the incidence of malaria is low. At one time, water used to collect around Delhi. After the hollows were filled, mosquitoes were greatly reduced and so was malaria."

Mahatma Gandhi, 'Navjivan' Dated 2-11- 1919

Bapu was deeply distressed by stark contradiction existing between our religious precept - "Cleanliness is next only to godliness" - and the ubiquitous deficit of environmental sanitation and hygiene in India.

Fig. 1: Father of our Nation, on a scavenger's job in South Africa

Environmental sanitation envisages promotion of health of the society through providing clean surroundings and thus breaking the cycle of communicable diseases. It depends on diverse factors that include sanitary habits and status of people, availability of different types of resources, innovative and suitable technologies according to the requirement of the society, socio-economic status and development of the country, cultural factors associated with environmental sanitation, political commitments, capacity building of the sectors concerned, social factors including behavioural pattern of the community, adopted legislative measures etc. Our Country is still lagging far behind as compared to many countries in this field. Contaminated sanitary conditions are terrible in India and need a sensitive sanitary awakening similar to the one which took place in London in 19th century. Improvement in sanitation requires innovative strategies and target oriented interventions with follow-up assessment/s. The need of time is to analyze the existing system of environment sanitation with respect to its structure and functions and to decide the control strategies according to the requirement. These priorities are principally important because of issue of water constraints, speedy population expansion, health problems, unequal distribution of water resources, administrative problems, industrialization and urbanization, migrating population, and rapid economic escalation.

Water, hygiene, and sanitation are the most important basic requirements which are needed to ensure public health. Still approximately half of the world's population i.e. 2.4 billion people, lacks proper sanitation and one sixth of the world's population i.e. 1.1 billion people, has no availability of safe and affordable drinking water. Lack of these basic necessities is intense in poorer, developing countries, and affects both, urban and rural areas. According to the WHO (World Health Organization), 80% of diseases, is associated with deficit of access to safe drinking water, inadequate and inappropriate sanitation, and poor hygiene conditions.

Fig. 2: Clean & Safe water: Is it available to everyone?

As per estimates, in 2006, inadequate sanitation cost India around $54 billion or 6.4% of the country's GDP. Over 70% of this economic brunt or about $38.5 billion was health-related, diarrhoea followed by acute respiratory infections accounted for 12% of the health-related impacts. Evidences suggest that all sanitation and water improvements are cost-effective in all developing sub-regions of the world.

Societal demand for water is increasing rapidly in India, mainly due to urbanization and according to estimations made by 2025, approximately 50% or more of the country's population will be residing in cities and towns. Rising incomes population increase, and industrial growth are responsible for this theatrical shift. National urban sanitation policy of the year 2008 was the recent development to quickly promote sanitation in all cities across the country. Ministry of Urban Development, India commissioned the survey as an element of its National urban sanitation policy in November 2008. Local government institutions in rural areas, which are in-charge of maintaining and operating the infrastructure, are seen as fragile and lacking in financial resources to perform their functions. In addition, no big city in India is known to comprise of a continuous water supply system and according to an estimate, 72% of citizen of Indian still lack access to better sanitation services.

"Our lavatories bring our civilisation into discredit. We like to take an enjoyable bath, but don't mind dirtying the wells, rivers and tanks, by whose side we perform ablutions. These practices should be considered as a great vice. These are responsible for the disgraceful state of villages and the sacred bank of sacred rivers and for the diseases that spring due to lack of sanitation."

'Our Dirty Ways' by Mahatma Gandhi in Navajivan, 13 September 1925

In India, only 36.4% of the entire population have proper toilets, making it one of the weaker nations for sanitation point of view in the world. This means increased widespread open defecation which causes contamination of the water resources and spread of diseases transmitted through insects. In addition, in India, there are dry, or basket-type toilets, which require manual removal of feces. Currently, India has over 8 million dry toilets, requires 750,000 scavengers every day to manually remove and cart human excreta for its disposal with no protecting gear. Not only is the work inhumane, but it is highly dangerous also. The indecent removal of human waste causes these workers to be infected and thus communicate many diseases to others also. Therefore, such easily preventable diseases as diarrhoea (just a simple action of washing hands with any kind of soap and water can decrease the number of diarrhoeal disease surprisingly by one-third), Cholera, Malaria, Hepatitis and Typhoid are main causes of mortality due to diseases in India and in other third world countries.

Fig. 3: Water can be lethal too

Following are some facts, collected from various sources, prevailing in the country:

- India has over 8 million dry toilets, requiring more than one million scavengers everyday to manually remove and carry human excreta for its disposal.
- Over 77% of rural families in the country do not have toilets. (Census 2001)
- 29% of urban families in India do not have toilets. (Census 2001)
- Two out of five people in India do not have access to safe drinking water. (Census 2001)
- India spends 73 million working days in a year due to sicknesses caused by lack of sanitation and unsafe water. (WASH Facts & Figures, 2003)
- 2.2 million People in developing countries of the world (most of them are children) die every year from diseases associated with inadequate sanitation and poor hygiene, and lack of access to safe drinking water. (WASH Facts & Figures, 2003)
- In India, only 40% of primary schools have toilets. (DDWS, 2003)
- In a survey, it is estimated that approximately half of the world's hospitals' beds are occupied by the patients who are suffering from diseases which are caused either due to poor hygiene or are water-borne. (WASH Facts & Figures, 2003)

"Any city that would attend to its sanitation in a true spirit, will add to both its health and wealth."

–Mahatma Gandhi

Water and sanitation affect not only to health, but to other vital aspects of life also. The economical condition of India as a whole is getting affected due to the fact that people are paying for visits to the doctor and may lose their jobs due to their inability to go to work. In rural areas, the condition is all the more painful. Education is getting adversely affected when girls drop out from schools once they attain adolescence because of lack of proper sanitation facility in schools. Rights of women are also on stake as they are being forced to wait until it gets dark to answer the nature's call in order to preserve their privacy. The condition was so poor that the United Nations, in 2001, declared sanitation as one of its main priorities of the Millennium Development Goals, aiming to reduce the data by half that lacks sanitation and access to clean water by the year 2015.

In the past, however, it seems that since water and sanitation were majorly a problem of poor, the crisis has chiefly been ignored and disregarded. It is estimated that diarrhoea, pneumonia, malaria, and tuberculosis which account for more than 20% of disease burden of the world, receive the delivery of less than 1% of total private and public funds dedicated to health research.

Not only in case of humans, but environmental sanitation has also a crucial role to play in maintaining continuity in evolution and advancements in other groups of classification too. All kinds of flora and fauna on earth, also deserve to inhabit a safe and supportive habitat which is not being provided to them due to undesired human interventions which result in poor sanitation. Accumulation of fertilizers in food chains or water cycles can be lethal to them and their future

generations. However it is just the ignorance which is accumulating al such problems and it can be easily removed by making the human species aware and by bringing about a behavioural change.

Fig. 4: People helplessly using unsafe water

Some government agencies, academic institutions and NGOs are taking innovative steps to either develop cost-efficient technologies and implementation strategy or to educate and motivate communities to adopt better/newer ways/technologies for the purpose. The Environmental Sanitation Institute in India, along with its NGO, has been continuously working for last 40 years to implement appropriate sanitary and hygiene practices like washing hands, using toilets for excretion, using soakage pits for waste water, and using trashcans for garbage collection through both construction and training to improve these conditions.

A number of innovative approaches to improve sanitation and water supply have been tested in the country in the year 2000. These include community-led total sanitation, public–private partnerships to improve the continuity of urban water supply in Karnataka, and demand-driven approaches in rural water supply since 1999.

Complete sanitation drive gives strong stress through capacity building and hygiene education for effectual behaviour change, Information, Education, and Communication (IEC) with involvement of community-based organizations and Non-Governmental organizations (NGOs), Panchayati Raj Institutions (PRIs) etc. The key intrusion areas are individual household toilets, Anganwadi toilets supported by Rural Sanitary Marts (RSMs), community sanitary complex, school sanitation and hygiene education (SSHE), and production centres (PCs). The main goal of the government of India (GOI) was to remove the practice of open defecation by 2010. To boost this endeavour, GOI has launched Nirmal Gram Puraskar to acknowledge the efforts in terms of cash awards for completely covered PRIs and those institutions and individuals who have contributed notably in ensuring full sanitation treatment in their area of operation. The scheme had been implemented in rural areas considering district as a unit for operation/implementation.

A recent research highlighted that policy shift to take account of better household water quality management to complement the advancing expansion of coverage and up gradation of services would appear to be a cost-effective health intervention in many of the developing countries. Most of

the interventions (including hygiene and water quality) were found to be decreasing the amount of illness due to diarrhoea significantly, with the biggest impact being seen for hygiene and household treatment interventions. Plans to improve water quality at the household level are more effective than those at the source site. It is sad to know that in developing countries, public health concerns are generally raised on the institutional setting, such as environmental sanitation, hospitals, municipal services etc. There is a sort of disinclination in acknowledging the home as a site of equal importance along with the public institutions, in the chain of communication/transmission of diseases in the society/community. Members of management system of community and home hygiene must act in unanimity to optimize return from hard work to support public health. A survey through profound interviews with more than eight hundred households in the city of Hyderabad in India concludes that, a substantial proportion of poor households would spend in water and drain network connections, even if provided with market (not concessional) rates of financing.

WHO Guidelines related to drinking water quality give emphasis on an integrated approach for assessment of water quality and its management from source to consumer. These guidelines also emphasize upon prevention of contamination and quality protection, and advises to be participatory and proactive, and addresses the needs of those who have no access to piped water supplies in their community. The guidelines call attention to the maintenance of microbe quality to prevent waterborne infections as an essential objective. In addition, they address protection from chemical toxicants including other contaminants of civic health concern.

Fig. 5: Pathetic condition of public toilets

When conditions of sanitation are poor, water quality improvements may have negligible impact regardless of amount of contamination in water. If each transmission pathway alone is sufficient to spread a diarrhoeal disease, single-pathway interventions will have negligible benefit, and ultimately an intervention will be successful only if all adequate pathways are eliminated. However, when any pathway is critical in maintaining the concerned disease, public health efforts have to mandatorily focus on this critical pathway. The affirmative impact of improved water quality is largest for families which are living under superior sanitary conditions, with the effect statistically noteworthy when sanitation is considered/measured at the community level but not significant

when sanitation is considered / measured at the household level. Improvement in drinking water quality will not be effective in neighbourhoods with very pitiable environmental sanitation; however, in areas which are blessed with better sanitatary conditions in the community, reduction in the turbidity of coliforms of fecal matter by a remarkable degree, would lead to a 40% lessening in diarrhoea. Providing means of disposal excreta on their own would be expected to trim down diarrhoea by 42%, while eliminating excreta from surroundings of houses would lead to a 30% decline in its cases. The findings report that improvements in the areas, sanitation and water supply, are necessary if it is needed to improve infant health. These also imply that the condition is not epidemiologic but behavioural, and economic factors should precisely determine the precedence in interventions. Another research highlighted that water quality interventions for water treatment were reported to be more effectual than thought previously, and multiple interventions (consisting of water quality, sanitation, and hygiene measures) were not more efficient/impactful than interventions with a single focus. Actual findings have shown that just a small step - hand washing can reduce diarrhoeal episodes by approximately 30%. This noteworthy reduction is analogous to the effect of providing safe water in low - income areas.

Lack of supply of safe water, improper disposal of human excreta, poor environmental sanitation, and poor personal hygiene, are major contributors in perpetuating and spreading diarrhoeal diseases. Because these diseases are caused by 20–25 pathogens, vaccination, though an attractive disease prevention strategy, is not practical. However, as most of the childhood diarrhoeas are caused by *Vibrio cholerae, Shigellae dysenterae* type 1, rotavirus, and enterotoxigenic *Escherichia coli* which have a high morbidity and mortality, vaccines against these organisms are necessary for the control of spread of epidemics. A strong political will along with appropriate budgetary allocation is indispensable for the control of childhood diarrhoeal diseases in the country.

Mortality and morbidity, because of waterborne diseases, have not declined proportionately with increase in accessibility to potable water. More crucially, young children bear a big part of the burden of these diseases which are resulting from the deficit of hygiene. India still loses between 0.4 and 0.5 million children under 5 years due to these diseases. While infant and under 5 mortality rates have declined over the years for the country as a whole, in many states, these have stagnated in few recent years. One of the major reasons is failure to make considerable progress in improving home and personal hygiene, especially in taking care of newborns and young children.

National water policies are shifting to community-based management approach because local authorities are in regular contact with users. Historically, national policy shifted from attention to distribution of investments in the concerned sector for restructuring water agencies and for building up the competence of private or voluntary agencies. The confined context allows for more efficient and effectual responses to local conditions. Local groups and institutions are better equipped to solicit participation at local level. Planning of Local water resource is also very important in fortification of the economic and individual power of poor people in areas under development. Experience of Mahesana, Sabarkantha and Banaskantha, in Gujarat state supports this

lesson learned. Some of the major hindrances in Gujarat to water resource improvement were identified as inadequate provision of services due to remoteness of the area, amplified demand for public water services and financial limits of central agencies. Infrastructure is also inadequately maintained.

The agriculture sector accounts for approximately 90 and 95% of ground and surface water in India, while industry and domestic sector account for the remaining resource. At the same time, several significant measures are being taken to deal with the abovementioned issues. The National Water Policy, 2002, on the water resources management front, recognizes the requirement for well-developed information systems at the state and national levels, and gives a strong emphasis on non-traditional methods for utilization for example inter basin transfers, desalination of brackish or sea water, artificial recharge, as well as conventional water conservation/preservation practices such as rainwater harvesting, etc., to increase resources of usable water. It also advocates treatment of catchment area, watershed management through extensive soil conservation, conservation of forests, and increasing forest cover and check dams construction. The policy also identifies the latent need for reorganizing and reorienting institutional set -ups for the sector and stresses upon the necessity to maintain existing infrastructure.

Because no broad / comprehensive study on equity concerns relating to sanitation, water supply, and health had been conducted for the country as a whole, common equity issues that plague the sector in most of the countries under development, hold true for India also. In addition, any broad/comprehensive study on sanitation and economical value of the water sector in India also does not exist.

It is important to reiterate the need for Rural Water Supply and Sanitation [RWSS] and Urban Water Supply and Sanitation [UWSS] agencies to be operational hand-in-hand with their education and health counterparts to jointly monitor indicators / parameters of health, poverty, education, UWSS, RWSS, and equity in order to make important progress in the particular sectors. Existing health promotion and education series should be made well structured and more effective and geared towards achieving behaviour changes which are highly needed for the betterment of hygiene conditions.

Percentage of urban population without proper sanitation in India is 63%. The 11th five year plan envisaged 100% coverage of urban water, urban sewerage and rural sanitation by 2012. Although investment in water supply and sanitation is likely to see a jump of 221% in the 11th plan over the 10th plan, the targets do not take into account, the quality of water being provided, or the sustainability of systems being put in place. Increasing emphasis on use of information technology applications in management and urban governance to ensure quick access to planning, information and decision support systems are the key concern areas related to environmental sanitation. Solid waste management is also progressively seen as more important area in UWSS. Legislation on municipal waste treatment and management has been passed in October 2000. Some strategies on

solid waste management include preparing town-wise master plans, giving training to municipal staff, IEC and awareness generation programme, involvement of community-centred and non-governmental organizations, setting up and operation of compost plants with the help of NGOs and private sector, enhancement of the holding capacities of some state structures such as State Compost Development Corporations with emphasis on commercial operations and private sector participation. Variety in housing type, density and settlement layout, poverty condition, and access to networking services will lead to different solutions for sanitation in different areas of the city or within the same neighbourhood. Major challenges are as follows:

- Prevention of water from getting contaminated in distribution/supply systems
- Growing water scarcity and the exploration of potential for water reuse and conservation
- Implementing pioneering low-cost sanitation structure
- Providing sustainable water supplies and sanitation for urban and semi-urban areas
- Dropping disparities within the regions of the country
- Sustainability of services related to management of water and sanitation

The public health challenge inherent in meeting the global targets is ensuring that improvements necessarily result in access to water and sanitation for crucially at-risk populations. Novel approaches are required to ensure the availability of low-cost, and locally acceptable water and sanitation practices and integration of these approaches into existing social institutions such as education institutes, shopping areas, and health sector.

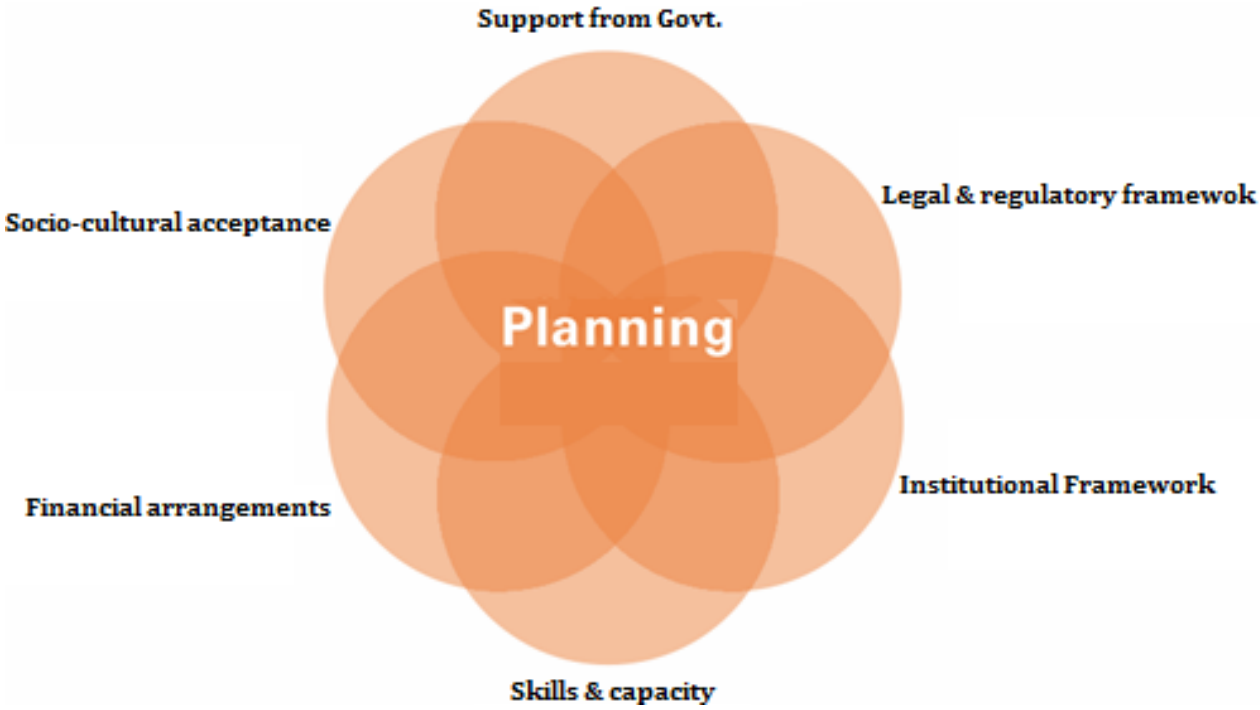


Fig. 6

Execution of low-cost sanitation system with lower subsidies, more household involvement, range of technology options, choices for sanitary complexes for women, drainage systems in rural areas, IEC and awareness building, involvement of NGOs and local groups, availability of finance support, human resource expansion, and weightage to school sanitation are some of the important areas which are to be considered. Also appropriate forms of private sector participation and public private partnerships (PPPs), evolution of a strong sector policy in Indian context, and stress on sustainability with political support and commitment are prerequisites to bring about the change. The requirements can be communicated schematically as shown below:

But more than anything else, it is required to change the behaviour of people so that they can sustainably adopt good sanitary practices. However, changing hygiene behaviour is harder than it may appear at first sight. Since it is related to tradition, environment, culture, and economy, improving existing sanitary practices, involve paying attention to the requirements and desires of the community. In the past, toilets have been built only to be used as storage amenities. In other cases, people have not been educated about how to use and maintain toilets, led to causing them to become unserviceable.

Fig. 7: Clean surroundings: Everyone's fundamental right and moral responsibility

In order to sensitize people towards the needs of the community so that their efforts are successful, proper training and education is a fundamental necessity. Training that is holistic and practical and covers all areas should be given each strata from professionals in the field of water and sanitation to grass root NGO workers, to panchayats of villages to ensure embodiment of concepts as well as their sustainability. Many NGOs in the country intend to fulfil this need by providing a centre of excellence for water and sanitation to increase the capacity of field workers in the growth sector and of all related stakeholders. By behaving in this manner, we are sure that we will be able to continue our work in upliftment of the downtrodden, up gradation of rural and urban wellbeing, creation of environmental consciousness, and betterment of the sanitation condition of Environment.

Web links referred:

- https://in.news.yahoo.com/dont-urinate-public-gandhi-said-way-back-1925-134804693.html
- http://www.vancouverdesi.com/lifestyle/dont-urinate-in-public-gandhi-said-way-back-in-1925/797567/
- http://www.linkedin.com/today/post/article/20140928175615-153568249-gandhiji-s-views-on-environment-sanitation-hygiene
- http://www.gandhi-manibhavan.org/gandhiphilosophy/philosophy_environment_sanitation.htm

Sample Questions

1. Poor environmental sanitation can lead to adversities in a city. Mention some innovative ways to spread awareness about them and to improve it to a remarkable level. Maintenance of environmental sanitation is directly proportional to the health of the society and it is also responsible for economic escalations. Justify with suitable examples. 5 marks

2. Improved Environmental Sanitation brings about richness and scarcity in biodiversity. Poor environmental Sanitation brings about richness and scarcity in biodiversity.

   Analyze both of the above statements; describe them with suitable examples in support of each aspect. 5 marks

Marking Scheme

1. Assessed as a whole covering all necessary aspects 5 marks
2. Assessed as a whole covering all necessary aspects 5 marks