An International Edited Book

ISBN: 978-81-954002-7-0

ENVIRONMENT AND SOCIETY 2022

Editors

Dr. Sadguru Prakash
Dr. A. K. Verma
Dr. R.C. Mishra
Dr. Madhu Laxmi Sharma

Associate Editors:

Dr. Sunita Arya
Dr. Seema Margret Singh

Published by

Nature Light Publication
Pune

GESA, New Delhi
www.gesa-india.org.in

An International Edited Book *ISBN-978-81-954002-7-0*

ENVIRONMENT AND SOCIETY 2022

Editors

Dr. Sadguru Prakash
Department of Zoology
MLK PG College, Balrampur, (U.P.), India

Dr. A. K. Verma
Department of Zoology
Govt. PG College, Saidabad, Prayagraj (U.P.), India

Prof. R. C. Mishra
Vice-Chancellor
Mahakaushal University, Jabalpur (M.P.), India

Prof. Madhu Laxmi Sharma
Department of Botany
Govt. KRG PG (Autonomous) College, Glawlior, (M.P.), India

Associate Editors

Prof. Sunita Arya
Department of Zoology
DG PG College, Kanpur (U.P.), India

Dr. Seema Margret Singh
Department of Botany
Govt. PG (Autonomous) College, Datia (M.P.), India

Published By

Nature Light Publications, Pune

Glocal Environment and Social Association (GESA), New Delhi, India

Environment and Society 2022

ISBN- 978-81-954002-7-0

An International Edited Book

Editors

Dr. Sadguru Prakash
Dr. A. K. Verma
Prof. R. C. Mishra
Prof. Madhu Laxmi Sharma

Associate Editors

Prof. Sunita Arya
Dr. Seema Margret Singh

Published in February 2023

Published by:

Nature Light Publications, Pune

Glocal Environment and Social Association (GESA), New Delhi, India

Preface

Natural and man-made hazards and disasters, such as droughts, floods, cyclones, hailstorms, frosts, illnesses or losses, among others, have a significant impact on the Indian agriculture sector. All of these hazards and catastrophes carry the potential for the loss of human lives and agricultural output, which would irreparably loss the agricultural sector and, in turn, the overall national economy. Natural disasters are becoming more frequent and more severe, which have a very negative impact on agricultural production because it is highly susceptible to climate change. Food security has been put at risk due to the adverse impacts of climate change on agriculture, which might also impede several livelihood activities on which a lot of rural people depend totally.

For a very long time, there was a critical and urgent need for research into this global issue. Hence, the GESA decided to organize an International Conference on "Environment and Society (ICES 2022)" on 23rd and 24th December, 2022 at Jiwaji University, Gwalior (M.P.), India to deliberate on issues concerned with such a threat. This edited book is based on lecture materials provided by invited speaker and delegates during the international conference on with the theme 'Recent Advancement in Disaster management, Agriculture and Environmental sustainability' organized by GESA, New Delhi in association with Jiwaji University, Gwalior, National Institute of Disaster Management (NIDM), Ministry of Home Affairs, Govt of India and others. This conference was young academicians, research scholars and P.G. student oriented and during conference invited speaker and delegates discussed environmental, agriculture and disaster management related issues.

The target audience / readers of this edited book include students, junior researchers, and professors teaching on the ecology, environmental science, agricultural sciences and disaster management, although senior researchers can also use this book as a handy and compact reference.

It is a privilege and a great pleasure for us to extend thanks to all those who have contributed their articles / chapters in this edited book. Authors are thankful to GESA, New Delhi for providing financial assistance otherwise it was not possible to publish articles / chapters in this edited book. The authors are also grateful to all those who have helped us directly and/or indirectly in preparing this edited book. We extend our sincere thanks to M/s. Nature Light Publications, Pune to publish this book in such a nice form. The editorial board and publisher bear no responsibility, if any error or omission has inadvertently crept in the printed text and express their due apology in advance.

Earth Day 22.04.2023

Editors

Environment and Society 2022

Table of Content

Environment and Society 2022

Table of Content

Environment and Society 2022

Table of Content

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 01 - 08 |

Wetland: An impact of Environmental Degradation and its Conservation

Ashok Kumar Verma[1], Sadguru Prakash[2]*

[1] Department of Zoology, DDU Govt. P.G. College, Saidabad, Prayagraj (U.P.)

[2] Department of Zoology, M.L.K.P.G. College, Balrampur (U.P.)

*Corresponding author: sadguruprakash@gmail.com

Abstract

Wetlands are valuable natural resource that can provide ecosystem benefits at both the local and regional levels. Despite being dispersed, they have an impact on the world's biogeochemical and hydrological cycles because of their distinctive features. Globally, both the quantity and quality of wetland areas continue to decrease. Depending on the area, between 30-90% of the world's wetlands has already been lost or significantly modified in many countries. The ecosystem benefits that wetland provide are not available to people as a result of wetland loss and degradation. Over the past few decades, there has been a significant change in people's perceptions of wetlands. The protection of remaining wetlands was once seen as a static resource for biodiversity, but more recently, the emphasis has shifted to the many, formerly unprotected wetlands.

Keywords: Wetland, Wetland Ecosystems, Conservation.

Introduction

Wetlands are a type of aquatic ecosystem that makes up about 6% of the Earth's land area (Cools *et al.*, 2013). Except for Antarctica, every region has wetlands, which can be found in every climatic zone. Low-lying areas of the environment where water collects near or above the soil surface give rise to wetland formation. Wetlands are a distinct environment that exists between aquatic and terrestrial ecosystems, or between dry ground and an open body of water (Gebresllassie *et al*., 2014).

The primary nutrient cycled in wetlands is carbon. The majority of nutrients, including sulphur, phosphorus, carbon, and nitrogen, are present in wetlands' soil. The cycling of nutrients such as carbon, hydrogen, oxygen, and nitrogen as well as the solubility of phosphorus are affected by anaerobic and aerobic respiration in the soil, which affects the soils and water's molecular composition. The saturated soils of wetlands are frequently anoxic because oxygen moves through water more slowly than it does through air (Schlesinger *et al*., 2020). The Ramsar convention defined wetlands as "area

of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six meters."

Freshwater wetlands are bodies of water that are linked to major river systems in some way, accommodating swollen waters and being a major factor in preventing floods and irrigating croplands. Wetlands are regions where water plays a major role in regulating the environment and the existence of the plants and creatures that live there. They develop where the land's water level is at or near the surface or where there is a thin layer of water covering the land (Ramsar, 2004).

Wetlands have traditionally been thought of as disease-carrying wastelands. They were therefore seen as a barrier to human development, which has resulted in extensive drainage and conversion for alternative purposes without consideration for ecological or socioeconomic values (Demissie and Addis, 2015). These are equally important for biodiversity. The biodiversity conservation is a necessity for ecological balance, sustainable development and human survival (Verma, 2017; Ashok, 2018; Verma, 2019).

Wetlands are among the world's most productive ecosystems and are often described as "Kidneys of land scope". They are cradles of biological diversity providing the water and primary productivity upon which countless species of plants and animals including fish, amphibians, reptiles, birds, mammals, and invertebrate species depend for survival (Prakash, 2020). They represent only a part of our land bases but they provide shelter to a great number of animal and plant species. Many species only use the wetland for a very small but important part of their life cycle such as for breeding and responding.

Importance of Wetland:

Wetlands perform a variety of functions. They carry out numerous tasks at once, and as a result, offer people a variety of benefits (Demissie and Addis, 2015). Many different species of plants, animals, and other organisms can only exist in wetlands because they are their only reliable source of water and nutrients. Wetlands serve as a habitat for such species including sarus crane (Prakash and Verma, 2016; Verma and Prakash, 2021). These organisms rely on wetlands, making them the most vulnerable in the event that a wetland is threatened.

Wetlands perform a number of important functions, including the provision of drinking water, fish, grub, fills, a natural living environment, flood control in urban areas, protection of shorelines from erosion, and entertainment for society. They also recycle supplements, refine water, prevent floods, energise ground water, and provide additional services (Kumar and Kanaujia, 2014). A significant number of small indigenous fish species that sustain subsistence

fisheries and provide livelihood to fisher communities, in addition to meeting the nutritional needs of the local population, call these areas home.

Wetlands provide 40% of all worldwide ecosystem services, despite only making up 6% of the planet's surface (Zedler and Kercher, 2005). These wetlands are in a crisis of rapid deterioration due to neglect, unplanned and unbalanced development requirements, and goals, despite all of their essential functions and values. As a result, wetlands are considered to be one of the most endangered environments in the world, and sadly, wetlands are continuing to deteriorate and disappear (Gebresllassie *et al*., 2014).

Fish supply and water availability are two of the most significant wetland ecosystem services that have an impact on human wellbeing. In developing nations, inland fisheries are particularly significant because they are the main supply of animal protein available to rural populations. Some populations are very dependent on these services and are immediately harmed by their degradation, especially those who live close to wetlands (Francois *et al*., 2005). However, threats to wetlands on all countries include land reclamation, extensive resource exploitation, hydrological changes, and pollution. Depending on the region, 30–90% of the world's wetlands have already been lost or significantly altered in many nations, and there is no indication that this trend is slowing down (Cools *et al*, 2013; Junk *et al*., 2013).

Status of Indian Wetland:

In India, there are 19 distinct kinds of wetlands. It encompasses an estimated 3% of India's land area and consists of mangroves, high-altitude lakes, marshes, and ponds or taals (Chatrath, 1992). Across the many river basins in India, there are about 8.0 lakh hectares of floodplain wetlands (beels, jheels, taals, mauns, chaurs, pats, etc.). Major wetland areas in the States include Assam (1.10 million hectares), West Bengal (0.42 million hectares), Bihar (0.05 million hectares), Uttar Pradesh (1.33 million hectares), Odisha (1.80 million hectares), Arunachal Pradesh (0.42 million hectares), Kerala (2.43 million hectares), Manipur (0.04 million hectares), J&K (0.06 million hectares), Gujarat (0.12 million hectare), Haryana (0.10 lakh ha) (Total: 7.98 lakh ha). Wetlands of Assam, West Bengal, Bihar, Uttar Pradesh, Odisha, Arunachal Pradesh and Manipur States are amongst the most important from fisheries point of view and account for 7.50 lakh ha of wetland water spread area.

Fish Production in wetland of Uttar Pradesh:

Besides contributing to the environmental sustainability through the nutrient cycle, the wetlands of India are the major sources for inland fish production of the country, offering vast potential for capture as well as culture fisheries. Fish production is directly or indirectly related with wetland (Prakash et al., 2020; Chakraborty et al., 2021; Singh and Prakash, 2022). The presence of many natural wetlands

in the form of Taals and ponds in the Tarai region of eastern Uttar Pradesh offers immense scope and potential for inland fishery development. Compared to potential output, the amounts of fish production in freshwater wetlands of India including Uttar Pradesh's were low. Harvesting is a major problem in most of them as they are usually weed-choked, obstructing use of fishing gear. Predators frequently cause high natural mortality rates in stocked fish, which results in poor productivity. In order to increase fish production from floodplain wetlands, enclosure fish culture systems are used. In these systems, a captive seed stock is grown to fingerlings (in-situ or ex-situ) on formulated feeds, protected from predators, stocked in the main water body or in cages, and harvested when the time is right. Selecting the right combination of fish species, based on trophic structure and potential of such wetlands, stocking seed of appropriate size (80-100 mm) and releasing them at the right time are essential to fully utilize all ecological niches and optimize fish yield from wetlands. Species most suitable for stocking in wetlands/taals include: Indian Major Carps (improved varieties), Indigenous Minor Carps, Exotic/Chinese Carps, etc.

Threats to Wetlands:

Both population pressure and development activities pose a danger to the wetlands. Some of the biggest dangers to wetlands in India are waste disposal and water pollution. India is also concerned about the detrimental effects that decreasing water quality in wetlands will have on its economy, society, and environment. Wetlands are threatened by human activity in a variety of ways. Due to the small water bodies, such as lakes, ponds and taals, the problem of declining water quality is particularly alarming. These freshwater bodies are frequently affected by changes in land use in their catchments, which cause a decline in inflow and deterioration of the "runoff" passing through urban areas and agricultural fields.

Freshwater wetlands can vary in sizes; small wetlands are frequently encountered and disregarded by man, despite the fact that they may support a healthy ecosystem. The local people are heavily dependent on the wetland. However, many small wetland ecosystems around the globe have declined in recent decades as a result of the conversion of wetlands into agricultural areas through reclamation and water drainage (Williams, 1991). The primary causes of the increased conversion of wetlands to agricultural lands are thought to be a lack of understanding and awareness of the social, economic, and ecosystem benefits of wetlands and the rising demand for agricultural land as a result of population pressure and upland area degradation (Afework et al., 2015).

The natural wetlands are already being affected by climate change, becoming drier in the summer (Farrington, 2014). Wetlands are losing and degrading more quickly than other environments. One of the main causes

of wetland degradation has been the uncontrolled discharge of human waste. The size and ecological state of many wetlands have undergone significant changes as a result of the conversion and loss of wetlands (Junk *et al*., 2013). Wetlands are frequently referred to as "wastelands" by many, which fosters the misconception that they are not significant as an environment. Water diversion for agricultural intensification, urbanisation, dam construction, pollution, and other forms of intervention are some of the activities that have a significant negative impact on wetlands (Abunie, 2001).

Threats to wetlands:

There have been numerous reports of wetlands degradation and decline caused by both natural and anthropogenic activities. Additionally, a far more devastating effect on these natural resources could result from a shift in the climate. India has experienced a significant shift in climate, with an upward trend in temperature (0.60 C over the past 112 years), as well as changes in the pattern and intensity of rainfall. Extreme climate change is predicted to have a significant effect on wetlands, which may be mediated by a number of different direct or indirect pathways. More human settlements are being built around the wetland and it was observed that the waste material was disposed on the wetland without any hesitation. Wetlands stressors can be chemical (e.g., toxic chemicals), physical (e.g., sedimentation), or biological (e.g., non-native species).

- Hydrologic changes have a major impact on the biodiversity of an area. Deposition of fill or waste material, draining, dredging and channelization, ditching and damming, flow redirection, and addition of impervious surfaces in the watershed, which increases water and pollutant runoff into wetlands, can all result in these changes.
- The intake of pollutants, such as sediment, fertiliser, human sewage, animal waste, road salts, pesticides, and heavy metals, may be greater than the wetland's natural capacity to assimilate them, leading to degradation. Pollutants can originate from runoff from cities, farms, forestry operations, and mines, air pollution, leaks from landfills and dumps, and boats stirring up debris near marinas.
- The grazing of domestic animals, the competition of non-native species with native species, and the removal of natural flora can all harm the vegetation of wetlands. Inadvertently or deliberately introducing invasive species can put pressure on native plants and ultimately drive them out of their natural habitat. This reduces a biotic community's variety and may drive some species out in search of habitats with better conditions. The resources mentioned here have more details about invasive species.
- The conversion of natural water bodies i.e. wetland to pisciculture

ponds for breeding of commercially beneficial fishes are one of the primary threats to wetland biodiversity.

Need wetland conservation

Nationally, almost 75% of all wetlands are owned by private citizens, making it imperative that the public get involved in the management and protection of wetlands. Thus, in order to protect the wetland and its pristine biodiversity steps must be taken to stop the habitat degradation and fragmentation. Following are the recommendations that help to conserve these natural freshwater wetlands:

- Fishery and forest department's attention must be drawn towards the wetlands because many of the world's wetlands are treated as wastelands. It must be made sure that wetland does not get treated as a wasteland. It must be made sure that this wetland does not get treated as a wasteland. Local forest department must be made aware of the globally threatened population of animals and birds using the wetland so that the wetlands get recognition for protection.
- Awareness should be created about the crucial importance of wetlands and their biodiversity in all stage; from local community, policy makers and all concerned bodies.
- Donate your time, money and materials to local wetland and watershed protection initiatives.
- If there are wetlands on your property, restore and protect them. Maintain wetlands and their buffer strips as open space. Avoid wetland alteration or degradation during construction projects.
- Work with your local municipalities and state to develop laws and ordinances that protect and restore wetlands.
- Purchase federal duck stamps to support wetland acquisition.
- Reduce or eliminate the amounts of fertilizers, herbicides and pesticides you apply to your lawn and garden.
- Encourage your friends and neighbours to join you in your efforts to protect wetlands in your watershed.
- The local government must take steps to ensure the proper disposal of the waste materials.
- State government make the laws and ordinances and enforce these laws strictly that protect and restore wetlands.
- Reduce or eliminate the amounts of fertilizers, herbicides and pesticides you apply to your agriculture field, lawn and garden.
- Hunting and poaching of the animals and birds must be immediately stopped.
- A big attention should be given for the sustainability of wetland resources.
- There should be a collaborative effort from different sectors and stakeholders.

If the following recommendations were followed and attention of the

department of fishery and forest are drawn into the wetland, it is possible to revert the negative changes the landscape has faced.

References

1. Abunie, L. (2001). Distribution and status of Ethiopian wetlands: Overview, Walia, 2001 (22):37-44.
2. Afework, Yohannes; Belayneh Ayele and Tilahun, T. (2015). Effect of Wetland Degradation and Conversion on Carbon Stock: The Case of Tekuma Wetland, Lake Tana Sub-Basin, 3(2):121-133.
3. Ashok, K.V. (2018). Ecological Balance: An Indispensable Need for Human Survival. Journal of Experimental Zoology, India. 21 (1): 407-409.
4. Chakraborty, B.K., Verma, A.K. and Muniya, S. (2021). Present Status of Aquatic Resource and Its Catch of Mogra River in Bangladesh. Sustainable Marine Structures. 3 (2): 26-38.
5. Chatrath, K.J.S. (1992). Wetlands of India. Ashish Publishing House.
6. Cools, J., Johnston, R. Hattermann, F.F., Douven, W. and Zsuffa, I. (2013). Tools for wetland Management: Learnt from a Comparative Assessment. Environmental Science and Policy, 34:138-145.
7. Demissie, F. and Addis, M. (2015). Human Development and Wetland Conservation Policy, 4(3): 126-138.
8. Farrington, L. (2014). Wetland conservation and restoration An update on wetland restoration on private land in South Australia, (February), 27-41.
9. Gebresllassie, H., Gashaw, T., and Mehari, A. (2014). Wetland Degradation in Ethiopia: Causes, Consequences and Remedies. Journal of Environment and Earth Science, 4(11): 40-49. http://doi.org/2224-3216.
10. Junk, W. J., An, S., Finlayson, C.M., Gopal, B., Kvet, J., Mitchell, S.A., …and Robarts, R.D. (2013). Current state of knowledge regarding the world's wetlands and their future under global climate change: a synthesis. Aquatic sciences, 75(1): 151-167.
11. Kumar, A. and Kanaujia, A. (2014). Wetlands: Significance, threats and their conservation. Environ, 7:1-24.
12. Prakash S. (2020). Conservation status of fishes reported from Semara Taal of District Siddharthnagar (U. P.), India. Int J Fauna Biol Stud. 7(3): 21-24.
13. Prakash, S. and Verma, A.K. (2016). Marital fidelity and congregation of Indian sarus crane, *Grus antigone antigone* in and around Alwara lake of district Kaushambi (Uttar Pradesh), India. International Journal of Biological Research. 4 (1):10-13.
14. Prakash, S., Kumar, A., Prakash, S. and Mishra, B.K. (2020). A Survey of Fish Fauna of Rapti River, Balrampur (U.P.), India. International Journal of Biological Innovations. 2(1): 76-81.
15. Schlesinger, W.H., and Bernhardlt, E.S. (2013). Biogeochemistry: an analysis of global change. Academic Press.

16. Singh, V. and Prakash, S. (2022). Ichthyofaunal diversity of Bhagda or Bhagta Taal, a wetland of Balrampur, Uttar Pradesh, India: Threats and conservation. Intern. J. Zool. Invest. 8(1): 412-420.
17. Verma, A.K. (2017). Necessity of Ecological Balance for Widespread Biodiversity. Indian Journal of Biology. 4(2): 158-160.
18. Verma, A.K. (2019). Sustainable Development and Environmental Ethics. International Journal on Environmental Sciences. 10 (1): 1-5.
19. Verma, A.K. and Prakash, S. (2021). Nesting Behaviour and Current threats to the Indian Sarus Crane around Alwara Lake of District Kaushambi (U.P.), India. International Journal of Biological Innovations. 3 (1): 127-133.
20. Williams, M. (1991). The human use of wetlands. Progress in Human Geography, 15(1):1-22.
21. Zedler, J.B. and Kercher, S. (2005). Wetland resources: status, treats, ecosystem services, and restorability. Annu. Rev. Environ. Resour., 30:39-74.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 09 - 15|

Sustainable Solution for Urban Environment: Miyawaki Forest

Mishu Singh
Department of Chemistry
Pt. Deen Dayal Upadhayay Govt. Girls P.G. College, Lucknow (U.P.)
Corresponding author: mishusingh17@outlook.com

Abstract

In the 1980s, Professor Akira Miyawaki presented a new and inventive reforestation method in Japan with the task to reinstate indigenous ecosystems, and preserving environment. Since then this method "MIYAWAKI", developed by him has been applied in many of the Asian Countries including China, India, Far East, Malaysia, and South America. Especially in rapidly developing economies (such as India and China), rapid urbanization, population growth, and rural-to-city migration have led to rapid declines in forest cover and green areas in many city centers around the world. According to a recent report, the green coverage of Delhi, the capital of India, is only 20.6%, showing a declining trend towards dense and very dense forests. In fact, India ranks first among the major countries in reducing the range of tree coverings. This is a disturbing situation and is not a good sign for human health and the ecosystem in general. The concept of Miyawaki forest proposes a exclusive solution. A large number of industries and cities have effectivelydeveloped Miyawaki forests for improving the tree cover and a healthier environment. The current work discusses the concept of Miyawaki forest, possibilities of its utilization. It is expected that Miyawaki forests will be able to reverse the declining tree cover, provide a better environment and improve our air quality.

Keywords: Miyawaki, Afforestation, Environment, Akira Miyawaki, Plantation.

Introduction

Rapid urbanization, industrialization, climatic changes, altogether has been the main anthropogenic reasons worldwide in abolishing natural environment and affecting ecosystem and increasing peril of desertification (Verma, 2021; Prakash and Verma, 2022). In the last two decades, researchers have developed new visions both in conjectural and in applied actions for restoration natural ecosystems (Clewell and Aronson, 2007). Humans live in a rapidly developing country where industrialization and urbanization is taking place at a very fast pace. Taking some hundred years for forest

restoration is too long for humans (Miyawaki, 1999). According to the latest theories based on vegetation-ecological theories, 'native forests by native trees, is the only unswerving method for forest restoration' (Miyawaki and Golley, 1993; Miyawaki, 1993a, 1993b, 1996,; 1998; Padilla and Pugnaire, 2006).

Dr. Akira Miyawaki (Blue Planet Prize winner in 2006) is the inventor of the technique, which has been in use since 1980. When trees are planted close together, they grow more rapidly because they are competing for the same amount of light. By planting a native tree assortment, Miyawaki was engineering the natural stages of ecological succession, which can help turn a degraded plot into a forest. Miyawaki was known for his work in forestry, monitoring the planting of over 1,500 forests throughout Japan, Southeast Asia, Brazil, and India.

Background of Miyawaki Method:

The Miyawaki Method was created by Akira Miyawaki. Miyawaki went on to study with botanist Reinhold Toxen in Germany, where he learned about the concept of potential natural vegetation (PNV). When he returned to Japan and applied the PNV principles to the Japanese landscape, he became interested in the remnants of ancient forests found around temples and shrines, known as Chinju-no-mori, sacred groves. These forest fragments are not coniferous trees such as Larch (*Larix kaempferi*) and Sugi (*Cryptomeria japonica*), but trees such as Japanese Blue Oak (*Quercus glauca*), Japanese Chestnut (*Castanea crenata*) and Sakaki (*Cleyera japonica*). Introduced from other areas, these dominated local forests. In the forest structure, there were also prominent layers of slow-growing canopy species, tree layer species, smaller sub-tree species, shrubs, and ground cover plants.

When Miyawaki combined these concepts, he developed a new way to plant forests. This is, as inferred from PNV studies; how these species interact with native plants that it should grow in the area and create a dynamic forest ecosystem was based on his understanding. His early field trials have shown promise that this method can dramatically accelerate forest growth and provide a stable and diverse forest ecosystem. Since then, Miyawaki Forest has been successfully planted in more than 3000 locations around the world.

Miyawaki Method:

The basic idea of the Miyawaki method is to use tree species that naturally occur in the area and work together to create a variety of multi-layered forests. This creates a resilient and prosperous forest ecosystem with species that complement each other and restore "indigenous forests through native trees." The choice of species to be planted in a particular area was originally related to the theory of potential natural vegetation (PNV), thevegetation that appears in a

particular area without human intervention. There is much debate about how to best define "native" species, but extensive research is being conducted around the world to determine PNVs around the world. In the United Kingdom, PNVs are primarily oak or oak/ash forests, with beech forests in southeastern England and northern pine forests in Scotland. Estuaries and wetlands are found in certain habitats, especially around the wash and at somerset levels. Native species are inherently difficult to define, but those adapted to local conditions (Oak, Yanagi, Birch, etc.) perform better than recently introduced species (horse chestnut, sycamore, etc.), and contribute to the improvement of biodiversity, a necessary aspect of ecological balance and sustainable development (Verma, 2017; Ashok, 2019). It takes about 200 years for the forest to recover naturally but such growth may be achieved in 20 years with the Miyawaki method.

Global Boom:

These fast-growing micro forests say, advocates of the method, could help cool concrete cities, clean the air, sustain wildlife, and form carbon sinks. The restoration method is quickly gaining popularity in government corridors and corporate boardrooms to improve urban spaces. Critics say that the theory behind the practice of yoga far outweighs the evidence in India. They argue that this method is expensive, its benefits are unclear, and Miyawaki's methods violate fundamental principles of environmental restoration. Across India, people are obsessed with trees. In Telangana, Uttar Pradesh, Karnataka, and Tamil Nadu, organizations are working to plant 2.3 billion seedlings in the next four years. If you plant trees correctly, they can provide a lot of benefits. The storage of CO_2 from human activity helps to reduce the Earth's temperature, sustain wildlife, improve the health of ecosystems, and provide jobs.

However, planting the wrong tree in the wrong soil, or in soil that has never supported the forest, is harmful. It reduces biodiversity, drives species toextinction, and impedes ecosystem resilience. Miyawaki's focus was on regaining lost natural vegetation in certain areas. Unfortunately, due to the speedy blowout of the process in India, many of the Miyawaki developments are deprived of a basic foundation. The local ecosystem is not only in the trees but in the home.

Biodiversity impact:

Even if done correctly, there was no assessment to compare the biodiversity and ecosystem impacts of Miyawaki Forest with comparable plots restored using other methods in India. Some questions remain unanswered: how do forests support endemic biodiversity? How do they affect groundwater? What carbon sequestration benefits do they offer? How can a method be accepted as an alternative without evidence? Researchers at the University of

Wageningen in the Netherlands have discovered that domestic Miyawaki forests support greater biodiversity than neighboring forests other than Miyawaki.

However, this type of comparative study has not been conducted in India. Proponents routinely claim that Miyawaki trees absorb 30 times more carbon than single-grown plantations. However, according to Dutch carbon sequestration data, the benefits of carbon absorption in Miyawaki forests appear to be comparable to the reforestation of other forms of native species. Apart from choosing the wrong tree, Miyawaki Forest is planted in many unsupported ecosystems, such as Kutch in Gujarat, Jaipur in Rajasthan, and Hyderabad in Telangana. If you're in the arid regions of Gujarat, Rajasthan, or other parts of the Deccan Plateau, there's no point in growing such forests because Miyawaki forests haven't existed before (Shanker Raman et al., 2021). Unforested habitats (from treeless deserts to savanna meadows to laterite plateaus) cover 3,19,000 km^2 (approximately 10%) of the area of the country.

Planting Miyawaki saplings in a dry landscape by pumping soil with water and nutrients can produce tree fragments that can destroy native ecosystems and push their dependent flora and fauna to their limits. New trees can affect the hydrology of native shrubs and grass-adapted areas by sucking up already scarce resources and depleting the water table.

Role of Miyawaki forests in mitigating urban heat island effects:

Few decades back afforestation was largely a means to generate income from timber but today, it is essential for our existence. Decreased green cover and increased concretisation in urban areas has led the cities become ‘urban heat islands’, which is not only posing threat to ecosystem but also contributing to climate change. According to World Resources Institute, India, almost 1.6 million hectares of green cover between 2001 and 2018 is lost. One possible technique to realize the target would be the Miyawaki method of afforestation to create dense, multilayered forests. The benefits of such plantation include lowering temperature, making soil nutritious, and appropriation of carbon content in air.

Miyawaki in India:

The Miyawaki project was backed by a commitment to improving India's green coverage from 25% to 33% under the Paris Agreement. Roughly speaking, there are more than 100 Miyawaki forests in India, but no one is tracking them. Without a comprehensive database of such projects, understanding of the long-term consequences and implications of national urban forestry is limited. From Thiruvananthapuram to New Delhi, India has hundreds of thousands of Miyawaki forest trees. The city of Chennai has promised to establish

1,000 mini-forests in the city. The largest Miyawaki forest is located in Hyderabad and is planted on 10 acres. These forests grew in the heart of a small city, around the school of Tirnerberg, around the temple of Tirchi, and even around the prison of Rohtak.

In India, this method is becoming increasingly important. “Afforest”, a social enterprise, has worked with various companies and individuals to create these forests. Recently, they worked with theGovernment of India (GOI)'s Biotechnology Department (DBT), remodeled land contaminated with sewage near the Balapura drainage channel. This was part of a larger project called Urban Sewage Flow Localization (LOTUS HR) for Healthy Reuse to Clean Drains. LOTUS is a joint initiative of DBT, the Ministry of Science and Technology, and the Government of India to build a demonstration plant to purify the Balapura drainage channel.

The way forward for an expensive method:

However, the problem with this method is to be costly. The cost of soil and land preparation can be high because urban land is usually in a degraded state. Second, these are dense plantations. As a result, the number of seedlings required increases, and the cost increases. The cost issue is a legitimate issue as the nursery supply chain is not fixed. In response to the sudden demand, the cost per sapling exceeded 100 rupees per sapling, and the cost increased significantly. The paradigm shift is shifting from tree planting to forest formation. It takes time to say that the result is 30 times better. If the cost is high, the results are much more valuable in comparison. We must empower people and be confident in their investment in plantations brought about by transparency and the effective use of technology.

From now on, the creation of Miyawaki Forest cannot be seen as an isolated solution, but as a small and important part of mitigating the effects of climate change. There is a need to move from plantations for ornamental landscapes to creating habitats for biodiversity native species in private and public projects. Not only to counter the effects of the heat island but also to deal with groundwater recharge. For government agencies, finding funding through unbid schemes is always a challenge. CSR takes over a small space and creates a forest in Miyawaki. An increasing number of ONGC and other public sector organizations have. In the future, if the public and private sectors join and this become a civic movement, it will help.

Criticism of technique:

unconventional method:

There was considerable criticism of the concept of potential natural vegetation, but the Miyawaki method itself was rare. In particular, the idea of using a fixed vegetation composition has been criticized because ecosystems are not static. However, it is undeniable that the concept of vegetation that is most

suitable for a particular area helps reforestation projects create forests that benefit native wildlife. Many research studies use PNV as a tool to identify potential species in a region, recognizing its limitations. The Miyawaki method itself has been criticized for creating a dull forest because it is the same age. However, the unique diversity of planting and the biodiversity recorded at the site indicates that a functional ecosystem has been created and that the appearance of the forest is a more aesthetic issue. This is a more expensive planting method as more saplings are needed to cover a particular area, but the rapid growth of the forest and the minimal maintenance required to offset some of that cost.

Environmentalist and founder of Eco-Watch Suresh Heblikar is absolutely against the Miyawaki method (Heblikariswww.ecowatchindia.org). According to him this can't be good. He said the technique does not fit for the tropical countries like India and China. He also stated that these Miyawaki forests grown at smaller spaces in or near cities lack qualities of natural forestsand the ability to bring rain. These plantations can only supplement and complement the natural forests.

Conclusion: The Miyawaki method is an effective way to initiate the creation of forests and forests that offer significant benefits to carbon sequestration and biodiversity restoration. In "Creating Tomorrow's Forest," the Miyawaki method is applied to restore other habitats such as ponds and pastures, creating a diverse and abundant forest ecosystem for both humans and wildlife. Well-established, biogeographically stable alien species that do not cause conservation problems should not necessarily be a source of concern.

References:

1. Ashok, K.V. (2019). Sustainable Development and Environmental Ethics. International Journal on Environmental Sciences. 10 (1): 1-5.
2. Clewell, A.F. and Aronson, J. (2007). Ecological restoration: principles, values, and structure of an emerging profession. Island Press, Washington DC.
3. Miyawaki, A. (1993a). Restoration of native forest from Japan to Malaysia. In: Lieth H, Lohmann M (eds) Restoration of tropical forest ecosystems. Kluwer Academic, Dordrecht, pp 5-24.
4. Miyawaki, A. (1993b). Global perspective of green environments - restoration of native forests from Japan to Malaysia and South America, based on an ecological scenario. IGRASS'93. Better Underst Earth Environ 1:6-8.
5. Miyawaki, A. (1996). Restoration of biodiversity in urban and periurban environments with native forest. In: de Castri F, Younes T (eds) Biodiversity, science and development. CAB International, Wallingford, pp 558-565.

6. Miyawaki, A. (1998). Vegetation ecological study for restoration of forest ecosystems. In: Fujiwara K (ed) A vegetation ecological study for the restoration and rehabilitation of green environment based on the creation of environmental protection forests in Japanese Archipelago. Inst. Veget. Sci., Inst. Environ. Sci. Technol. Yokohama Natl. Univ., 267-298.
7. Miyawaki, A. (1999). Creative ecology: restoration of native forests by native trees. Plant Biotechnol 16(1):15-25.
8. Miyawaki, A. and Golley, F.B. (1993). Forest reconstruction as ecological engineering. Ecol Eng 2:333-345.
9. Padilla, F.M. and Pugnaire, F.I. (2006). The role of nurse plants in the restoration of degraded environments. Front Ecol Environ. 4(4):196-202.
10. Prakash, S. and Verma, A.K. (2022). Anthropogenic activities and Biodiversity threats. International Journal of Biological Innovations. 4(1): 94-103.
11. Verma, A.K. (2017). Necessity of Ecological Balance for Widespread Biodiversity. Indian Journal of Biology. 4(2): 158-160. Verma, A.K. (2021). Influence of climate change on balanced ecosystem, biodiversity and sustainable development: An overview. International Journal of Biological Innovations. 3(2):331-337.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 16 - 28|

Molecular Biology in Sustainable Development and Conservation

Abhishek Singh[1*], Preeti Singh[2]

[1*]Department of Zoology, M.D.P.G. College, Pratapgarh (U.P.), India. 230001

[2]Department of Veterinary Pharmacology and Toxicology

College of Veterinary Sciences, LUVAS, Hisar (Haryana), India. 125001

[*]Corresponding author: abhizoology20@gmail.com

Abstract

Molecular biology involves the interaction of bio-molecules at the molecular level inside a living cell or body. This field allows scientist to study and analyze various molecules and pathways which cumulatively forms the basis of life. Conservation of vulnerable living organisms, especially endangered ones is the most important need for the environmentalist and conservationists. The conservation of flora and fauna is important to maintain the biodiversity of the world. In recent times, the conservation of organisms at the molecular level has come out as new field for the nature loving people. The study of genetic material has led to the scientists developing new tools for species and population conservation to minimize the risk of extinction and maintaining the natural balance. The molecular genetic techniques have allowed categorizing the organism and relating with its lineage. Genetic information is very useful in dealing with different populations of a species. This field has expanded enormously with major technological advancements to conserve the species. The genetic tools permit us for identification of parentage, distant families, unnamed individuals, population structure, population size, etc. It has also provided for more refined analysis of the structure of meta-population, hybridization, and demarcation of species, subspecies, sub subspecies and races. The necessity to conserve species arises due to the depletion of biological diversity as a consequence of endless anthropogenic activities on the earth.

***Keywords*:** conservation, sequencing, markers, anthropogenic, meta-population.

Introduction

Molecular biology implies the study of living things at the level of the molecules which makes and controls them. While traditional biology concentrates on studying complete living organisms and how they interact within populations, molecular biology help to understand living things by probing the constituents that make them up. Both approaches of biology are equally valid; however, developments in technology have allowed scientists to concentrate more on the biomolecules in recent years. The molecules which form the basis of life give scientists a more predictable and organised tool for the researchers to study. Working on the whole organisms or even just a single cell can be unpredictable, with the outcome of experiments depend on the interaction of hundreds of molecular pathways and the many other external factors. Molecular biology provides scientists a tool with which they may interfere with the different ways on which life works. They may use these pathways to determine the function of single gene or RNA or proteins, and find out what would happen if that gene or protein is absent or defective. Molecular biology is used to find out when and why some genes are switched on or switched off. An understanding of each of these factors has provided scientists a framework of how living things work, and use this knowledge to develop treatments for known and unknown disorders. Conservation biology has recently emerged as one of the fundamental scientific area which provide an understanding of many of the fundamentals of the field, such as, how to work on restoration of various habitats, how to conserve biodiversity, how to save endangered species, etc. Sub disciplines within the conservation biology including conservation genetics, molecular ecology, conservative ecology and many others have developed in recent years. The main emphasis of conservation biology is to maintain the world's biodiversity and sustainable development. Biological diversity seems to be the product of organic evolution and biological developments from the molecular level to the biosphere. This diversity is understandable when studied with the reference of organic evolution. It further includes the genetic diversity within the organisms, and the interactions between them which forms unique communities and ecosystems. The study of the biodiversity and its conservation require addressing diversity at different levels and in different ways. Conservation biology focuses mainly on to conserve the biodiversity and biological processes in the ecosystems, including genetic variation as a key component. Genetic variation is the primary foundation of higher levels of biodiversity. Without genetic variation, the population could not have evolved and adapted to future environmental changes. Because DNA is fundamental to all of the biological systems, the exercise of conservation mostly requires genetic studies, at the molecular level, which may pave the way for sustainable development in present as well future scenario.

Conservation Genetics

Conservation genetics is the application of genetic studies to understand the individual as well as population and reduce the risk of population extinctions. It deals with genetic factors which cause scarcity, endangerment and extinction, genetic management to reduce these effects, the use of genetic markers to help in resolving taxonomic uncertainties within the threatened species, to understand the underlying biology, and in the wildlife forensics. It is an applied discipline involving the evolutionary and molecular genetics along with the genomics. The need to conserve species of both flora and fauna arises due to the depletion of the biological diversity of the planet as direct or indirect consequences of the anthropogenic activities (Prakash and Verma, 2022). An unknown but countless number of species is already extinct, while many others have reduced their population sizes that have put them at risk of extinction. Many species now require immediate human intervention to ensure their survival. The economic value of bio resources, ecosystem services, aesthetics, and rights of living organisms to exist is primarily given as some justifications for maintaining biodiversity. IUCN recognizes the urgency to conserve biodiversity at all three levels; genetic diversity, species diversity, and ecosystem diversity. Genetics is involved in all three of these. Recent advances in molecular biology and biotechnology have opened a new chapter in the species conservation efforts, as well as the population biology. DNA sequencing, MHC (major histocompatibility complex), minisatellite, microsatellite, and RAPD (random amplified polymorphic DNA) procedures allow the identification of parentage, more distant relatives, unidentified individuals, founders to new populations, population structure, population-specific markers, effective population size, etc. The PCR (Polymerase Chain Reaction) technique involving the amplification of DNA (mitochondrial DNA, nuclear DNA, ribosomal DNA, chloroplast DNA) provide for more refined analysis of population structure, hybridization events, delineation of species, subspecies, races, all of which help in finding the species recovery processes. Each technique is powerful in its own right, but is most reliable when used in conjunction with other molecular techniques and most importantly with demographic and ecological data collected from the field. With molecular markers (such as segment of DNA, RNA or amino acids), it is now possible to find out the distributions of species that are difficult to study and to also improve the existing knowledge about other species. Phylogenetic trees along with fossil data can be used to assess the time when species separated from each other. Combining biological data on distributions (biogeography) and evolutionary relationships between the species along with the research in the field of palaeontology enable us to determine the climatic conditions and habitat characteristics, during past period

that have led to current species distributions.

Objective of Genetic Conservation

Conservation biology is a science that is concerned with the fortune of populations, which are defined and identified by their genetic component. This genetic makeup not only differentiates them from other populations, but also determines their ability to adapt to changing conditions and, further, to produce new species. The conservation of genetic diversity is foundational basis of all the conservation efforts because it is requisite for evolutionary adaptation and such adaptation is crucial for long-term survival of any species (Schemske *et al.*, 1994). To guarantee such survival, conservation biologists have two primary objectives in the area of genetics. One is to preserve substantial amounts of heritable genetic variation, particularly in small populations which are threatened with extinction. The other is to avoid the fixation of deleterious alleles, a fixation that can contribute to reduced fitness and accumulation of harmful mutations (Lynch, 1996). Preserving high levels of variation helps to hold population current reproductive fitness and also maintain its evolutionary potential, its capacity to adapt to any environmental change over long term. This preventing of fixation of deleterious alleles is intended to check declines in survivorship and fecundity that occur in small populations as a consequence of reduced genetic diversity. Thus, the two goals are closely interrelated, and the overall aim of conservation genetics is to preserve species not just as static forms, but as dynamic units capable of responding and surviving with environmental change with the time. When species possess adaptive potential, they have a reasonable hope of persistence in the changing world, and they possess this potential only by maintaining their genetic diversity.

Methods of genetic conservation

Recent molecular developments have led to evolution of many molecular tools which are accessible for deducing the systematic status of a living organism. One good source of information about evolutionary relationships among species and populations is provided by the circular, 16000 base pair segment of DNA confined in the mitochondria. The genes in the mtDNA are well defined, and have numerous universal primers, which target for particular DNA segments in specific genes and function effectively across a wide range of taxonomy. These genes are commercially available now. Each single cell contains many copies of mtDNA than the nuclear DNA, hence, mtDNA is easier to extract from small degraded samples. In most organisms, mtDNA is inherited maternally, therefore, only one copy of sequence can be extracted. The nuclear genes have the potential to provide more exact phylogenies but have been used less commonly because many of them require specific primers and cloning before their sequencing is possible. Nuclear genes have been used commonly in systematic studies include

those associated with the male-inherited Y chromosome genes in mammals (Lundrigan *et al.,* 2002; Makova and Li, 2002) and the highly variable major histocompatibility complex (MHC) region (Holmes and Ellis, 1999). As an alternative to sequence data, phylogenetic reconstruction can be achieved from short interspersed nucleotide elements (SINEs; Shedlock and Okada, 2000). Short interspersed nucleotide elements (SINE) are dispersed throughout eukaryotic genomes in large numbers. As the insertion event is an essentially irreversible phenomenon, the sequence of the DNA insertions can be traced over a lineage to achieve common ancestry among taxa. Short interspersed nucleotide elements have been used to infer phylogeny of African mammals, primates and reptiles, among other taxa (Nikaido *et al.,* 2003). The abundance of molecular data has promoted development of several new statistical methods for phylogenetic reconstruction that have been discussed elsewhere (Felsenstein, 1981, 2003; Hendy, 1993; Hillis *et al.,* 1996; Larget and Simon 1999).

Molecular markers

DNA marker or genetic marker or molecular markers allow detection of variations or polymorphisms which exist among individuals in the population. Molecular markers are DNA sections of an organism whole genome. These sections of DNA can be more readily obtained through a procedure known as the polymerase chain reaction (PCR). There are many different types of DNA markers used in molecular ecology, including: microsatellites (highly repetitive sequences of DNA that mutate rapidly and are often used to identify individuals), minisatellites (similar to microsatellites but with longer repetitive sequences), restriction fragment length polymorphisms (RFLPs, these are specific places of DNA that can be cut by enzymes yielding different size fragments of DNA in different species, populations), and DNA sequencing (the DNA bases are determined, similarities and differences are matched to identify species, populations, and individuals). Molecular markers have three main applications in gene mapping: firstly, a marker allows direct identification of the gene of interest instead of the gene product, and thus, it serves as a useful tool for screening somatic cell hybrids; secondly, it is used in several DNA probes as these marker helps in the physical mapping of the genes using the *in situ* hybridization. Thirdly, molecular marker helps in the construction of genetic maps using linkage analysis. A case study will elaborate its importance. The green turtle is endangered marine species whose movements were unknown until molecular markers provided some light on population structure and dispersal (reviewed in Bowen and Avise, 1995). Their long-life span, long time to sexual maturation, long migration distance, and the difficulty of monitoring individuals left biologists in a dilemma over population structure and status. Further, these green turtles, like other marine

turtles, use nesting beaches that are sometimes thousands of kilometres from their feeding areas, making it difficult to determine their breeding distributions. MtDNA genotypes have recently been shown to be population specific when populations are defined by their breeding beaches (Norman *et al.*,1994). These markers were not individual specific, but were specific enough to the biological populations and thus provide an understanding of the genetic origins of the individuals at feeding sites in the non-breeding season.

Population size estimation

It is difficult to observe or examine the population status of various threatened and endangered species as their living density is low, they roam over large areas, inhabit in those regions which are difficult to work in or they have an indefinable life style. Furthermore, many of these species are large (e.g. some marine mammals), dangerous (e.g. some carnivores) or secretive (e.g. some nocturnal marsupials), implying that the trapping of animals for the purpose of tagging is difficult and also expensive. Some animal body constituents such as scats, hair, pellets, feathers, sloughed skin, egg shells, urine and other body secretions contain small amounts of DNA that can be amplified by well-known technique called PCR. Consequently, an array of molecular (Bellmain*et al.,* 2004) and statistical (Valie`re*etal.,* 2002) methods are being developed to monitor the animal populations without the requirement of handling or even observing them. For example, hair or scats collected from brown bears (*Ursusarctos*) (Bellmain and Taberlet, 2004) and scats collected from coyotes (Kohn *et al.,* 1999) have been used to estimate the population size and to track individual movements and their living ranges. A prerequisite for this technique is that the samples are to be correctly identified, time and again using the species-specific DNA sequences. Sequences of any of the mtDNA genes are sufficient to allow distinction between hairs or any other body secretion collected from several species at any study site. The DNA extracted from any animal can be subjected to microsatellite analysis. By this method, one can identify different individuals based on their unique DNA fingerprint. An interesting complication could arise if, for example, one animal feeds on the other and the DNA of later showed up in the excreta of first one, in these cases, individual identification of DNA will be difficult because more than one individuals DNA would be amplified. New DNA extraction procedures and software are being developed in recent times. In coming years, these efforts, along with the systematic use of laboratory and scoring protocols, the automation of protocols, and the error rate quantification and reporting (Broquet and Petit, 2004) should help overcome many of these methodological problems.

Genetic diversity

One of the most disputed questions in conservation biology is about the cause of species extinction (Caughley, 1994).

Deterministic forces, like relentless harvest or increasing losses of habitat, noticeably place the species at high risk. When populations are small, random events become somewhat more important and they may play a major role in several extinctions. Huge variations in birth rates, population age structure and several other demographic processes also happen by chance in small populations. Due to same reason, small populations are susceptible to lose genetic diversity because of the rate of genetic drift which increases. The alleles become extinct by chance sooner than they are being created by mutation. Loss of diversity limits long term evolution, as the genetic variation is raw material for the natural selection to occur. Diverse populations are able to accommodate environmental variation in much better way. On shorter time ranges, loss of diversity decreases fitness due to the expression of deleterious or recessive alleles. In large populations, the selection phenomenon keeps such alleles at low frequency, therefore, they usually occur in heterozygotes, where their limitations are masked by a copy of normal alleles. In small populations, few deleterious alleles can drift to high frequencies, just by chance and can be expressed in homozygotes, thus, reducing fitness of the population by inbreeding depression. Populations that decline quickly in their size are supposed to undergo a genetic bottleneck. Conservation biologists have developed the concept of genetic rescue, which happens when inward migrants make a progressive contribution to population fitness. This rescue effect is likely to occur if the receiving population is small, isolated and also suffering from inbreeding depression. Under such circumstances, genetically divergent immigrants are able to import new alleles in the population to counter the tendency for loss of genetic diversity and to cover deleterious alleles causing inbreeding depression.

Gene flow in population

The habitat fragmentation is accelerating worldwide as roads, agriculture and other developments divide the habitats into isolated patches disrupting immigration as well as reducing the population sizes (Hanski and Gaggiotti, 2004). In many species, small populations are connected by dispersion into larger meta-populations, and these connectivity can be essential to the long term existence of the meta-population for both genetic and demographic reasons. Estimating the pattern of migration and its rate is thus very important for the conservation biologist. Genetic markers are used to the study the gene flow, or movement of genes among the population. These genes assimilate information about migration or isolation over evolutionary scale. Genetic markers, thus, can provide information not only about existing migration, but also the historical patterns of connectivity. The role of geographical distance is also important in shaping the genetic structure. Understanding relationship between the geographical and genetic distance is vital for any

conservation plan. When this relationship is high, geographical distance can be a meaningful barrier to distribution and utmost care is needed to conserve those populations which are close enough to permit enough genetic exchange. If the association between geographical and genetic distance is not found it indicates that some barriers to dispersal existed at large spatial scales, but it may also indicate that the populations are isolated over time and historical factors may have shaped the present day structure.

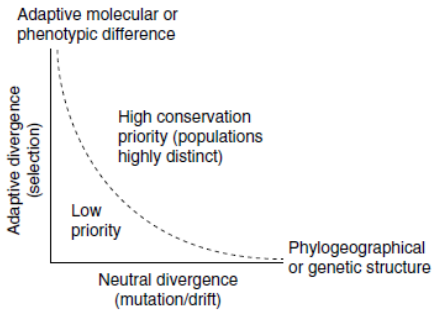


Fig 1. Adaptive markers could be treated separately from (but integrated with) neutral markers when prioritizing populations for conservation. Populations with the highest diversity and uniqueness for both adaptive and neutral markers would receive highest priority for conservation. (Luikart*et al.* 2003.)

Forensics

Recent molecular techniques allow forensic scientists to extract DNA from minute remains at a crime scene and relate it to a criminal. The power of forensic science is also important in the marine environment and in remote wilderness areas where poaching of threatened species is otherwise difficult to detect (Avise, 1998). Mitochondrial genes are useful for species identification using large databases available online (e.g. NCBI Genbank; DNA Surveillance, Ross *et al.*, 2003). Microsatellites and other highly variable markers can be used to identify the source population of poached specimens by comparison with a reference database using the assignment test (Manel *et al.*, 2002).

Molecular conservation in India

Specific plan for conservation is chalked out aiming to integrate the multiple disciplines of ecology, management, and genetics. One such plan in India is the Endangered Species Recovery Plan in respect of four species *viz.* Gangetic Dolphin, Great Indian Bustard, Dugong and Sangai Deer which aim successful recovery of the endangered species. This multidisciplinary approach is important because apart from the threats of anthropogenic and natural causes, species with small size population are normally more prone to extinction as they have poor genetic variability. In these type of cases, molecular involvements in species conservation is becoming critical worldwide. Assessing the genetic variations at population level is becoming more important in the understanding of species ecology as genetic diversity holds the history of a species, and it is vital for survival and future adaptation to changes. As the mentioned four target species have low population sizes, their fragmented habitats and combination of both '*in*

situ' and '*ex situ*' recovery plans, integration of molecular interventions would be critical to design and implement recovery plans. In the *in situ* component, genetic tools based on standard molecular marker will be used to find important biological understandings in the form of mitochondrial and nuclear genetic variations, population estimation, individual identification, demographic patterns, genetic structure, population connectivity, migration pattern, etc. Latest genomic tools are used to measure these biological parameters. Developments in genome sequencing and bioinformatics methods are allowing the scientists to do comparative genomic studies for getting better understanding on genome character and variation, identify the risk factors for genetic conditions, geographical distribution of variation, gather information on demographic events such as bottlenecks and population expansions, identify gene under selection and other important genetic parameters. In the *ex situ* component, the focus will be to explore some of the extensively used reproductive methods in captivity, such as cross-fostering, artificial insemination, artificial incubation, embryo transfer for improving reproductive success, increase population size and improve genetic variability. Use of cryopreservation techniques of genome, sperm, and gametes are becoming more common and widely used approaches in recent times as they permit to reintroduce the extinct species back to wild. Recently developed physiological approaches can be extremely informative in monitoring nutritional, psychological and reproductive health for both the *in situ* and *ex situ* species recovery plans. Measuring population dissimilarities in psychological and nutritional stress are critical in understanding how these pressures effect on the health and reproductive behaviour. This kind of multidisciplinary approaches is helpful in successful retrieval of the species in their individual habitats.

Future Prospects

In the coming years, forensic methods in collaboration with the molecular techniques will become standard tools for the conservation biology. Forensic and systematic studies of biodiversity could possibly benefit from emerging scientific projects such as sequencing a single mtDNA gene in all species on the planet (Hebert *et al.,* 2004). However, it will be important to merge these emerging molecular techniques with traditional morphological studies of authentic specimens to positively match the genotypes with actual species. Such information and PCR machines could allow rapid identification of species from minute tissue samples. With the help of GPS technology, much of the information that earlier required years of tiresome fieldwork, will be obtained in digital platforms within seconds. Identification of genes expressed in diverse range of organisms has been accomplished by the organised sequencing of cDNA libraries. Specific transcripts, called as expressed sequence

tags (ESTs), are developed from different tissues of a single organism. These ESTs can be used to construct collections of tissue-specific genes. Such DNA libraries constructed for the endangered or keystone species may provide much help in monitoring any environmental stress or any disorders in these populations. Single nucleotide polymorphisms (SNPs) representing key genes in any species of interest can predict the resistance of a population to any specific diseases. We can anticipate developing similar applications for conservation purposes. Another sensational tool is micro-array technology (Gibson, 2002; Pfunder *et al.*, 2004), which unlocks new perspectives in biodiversity monitoring. A single DNA micro-array comprises many thousands of characters based on the cDNA or oligonucleotides, on one microscopic glass slide. This technology has potentials to monitor the complete genome on a single chip so that we can have a better understanding of the interactions between thousands of genes simultaneously. A 'Mammalia Chip', for example, could include redundant diagnostic markers to unambiguously identify all European mammal species (Pfunder*et al.*, 2004). This type of application could serve as a forensic tool for poaching control. Micro-arrays were originally designed to measure gene expression, but now used for measuring DNA sequence variation. A chip designed for any specific endangered species is able to detect expression changes out of multiple genes. Understanding the adaptive phenotypic variations in any species is the most important tool for conservation purposes as these change in expression are closely connected to the fitness. With the help of micro-array scan analysis, a section of a population could reveal whether individuals are environmentally stressed or not and also the reasons causing it. Further, it tells the reproductive state of individuals, the parasite load, the ability of individual species to accommodate various selection pressures, etc. (Gibson, 2002). Combining the non-invasive methodology with the microarray technology makes a powerful tool that could provide a complete profile of any population out of the single sample.

Conclusion

Molecular biological techniques provide understanding into the role of individuals in a population, their internal relationships, and the differences among species and population. The supreme understanding of molecular information is attained when it is used in conjunction with ecological, physiological, behavioural and demographic data collected in the field. Incoming days, the evolution of new molecular and conservational techniques will enable us to identify individuals and the population structure with higher level of resolution. In the current scenario, with the increase in human population, the fight for physical space and natural resources is reaching near critical proportions across the globe. Natural habitats are being rapidly destroyed and are converted into specific human requirements which ultimately result in unprecedented loss of

biodiversity. Moreover, developmental activity since the industrial revolution is forcing species extinctions to serious levels and threatening the gross productivity of ecosystems (Abram *et al.*, 2016, Ceballos *et al.*, 2017). Humans are also vulnerable to this outcome since vital natural resources such as air, water and food are linked intricately to the health of earth ecosystems. As a realization, the climate change has become globally discussed issue and the importance of biodiversity conservation is understood. The field of ecology, biodiversity, natural history has come a long way in India and worldwide over a period of time. These fields have been transformed from an observational, field related exercise to a combination of various interrelated fields. Information related to ecological aspects of several species that could not be obtained earlier, due to their cryptic nature is now easily accessible through the modern techniques. Such information is found to be useful in conservation planning with respect to the present actions needed and future directions to be taken accordingly. Thus, Conservation biology is an irregular science as new crisis emerge every day and in most of the cases solutions are based on observation from related cases. Molecular biology is now helping to change that method by allowing conservation biologists to quickly examine a wide range of individual or population characteristics at any given site and thus help in sustainable development. Genetic data is most useful in conjunction with the traditional data such as demographics, distribution, life history, etc. Acquiring the knowledge of a population which is at risk, allow better understanding of the question in hand, and more comprehensive recommendations for the deciding body to save the nature.

References

1. Abram, N., McGregor, H., Tierney, J. *et al.* (2016). Early onset of industrial-era warming across the oceans and continents. *Nature.* **536:** 411–418. https://doi.org/10.1038/nature19082
2. Avise, J.C. (1998). Conservation genetics in the marine realm. *Journal of Heredity.***89:** 377-382.
3. Bellmain, E., Swenson, J.E., Tallmon, D., Brunberg, S. And Taberlet, P. (2004). Estimating population size of elusive animals with DNA from hunter collected faeces: four methods for brown bears. *Conservation Biology.***19:** 150-161.
4. Bellmain, E. And Taberlet, P. (2004). Improved non-invasive genotyping method: application to brown bear (Ursusarctos) faeces. *Molecular Ecology Notes.***4**: 519-522.
5. Bowen, B. W. and J. C. Avise. (1995). Conservation genetics of marine turtles. Pages 190–237 *in* J. C. Avise and J. L. Hamrick, editors. *Conservation genetics: case histories from nature*. Columbia University Press, New York, New York, USA.
6. Broquet, T. and Petit, E. (2004). Quantifying genotyping errors in

non-invasive population genetics. *Molecular Ecology.***13:** 3601-3608.

7. Caughley, G. (1994). Directions in conservation biology. *Journal of Animal Ecology.***63:** 215-244.
8. Ceballos, G., Ehrlich, P.R. and Dirzo, R. (2017). Biological Annihilation via the Ongoing Sixth Mass Extinction Signalled by Vertebrate Population Losses and Declines, *Proceedings of the National Academy of Sciences*, USA 114:E6089âA˘ S¸E6096.
9. Dyke, F. V. (2008). Genetic Diversity-Understanding Conservation at Genetic Levels. *Conservation Biology*. Springer.
10. Felsenstein, J. (1981) Evolutionary trees from DNA sequences: a maximum likelihood approach. *Journal of Molecular Evolution.***17:** 368-376.
11. Felsenstein, J. (2003) *Inferring Phylogenies.* Sinauer Associates, Sunderland, MA.DOI: 10.1080/10635150490468530.
12. Gibson, G. (2002). Microarray in ecology and evolution: A Preview. *Molecular Ecology.***11:** 17-24.
13. Hanski, I.A. and Gaggiotti, O.E. (2004). *Ecology Genetics and Evolution of Metapopulations: Standard Methods for Inventory and Monitoring.* Academic Press, San Diego, CA.
14. Hebert, P.D.N., Stoeckle, M.Y., Zemlak, T.S. and Francis, C.M. (2004). Identification of birds through DNA barcodes. *PLoSBiol***2**: e312. doi.org/10.1371/journal.pbio.0020312.
15. Hendy, M.D. (1993) Spectral analysis of phylogenetic data. *Journal of Classification*. **10:** 5-24.
16. Hillis, D.M., Moritz, C. and Mable, B.K. (1996) *Molecular Systematics*, 2nd edn. Sinauer Associates, Sunderland, MA.
17. Holmes, E.C. and Ellis, S.A. (1999). Evolutionary history of MHC class I genes in the mammalian order Perissodactyla. *Journal of Molecular Evolution*. **49:** 316-324.
18. Kohn, M.H., York, E.C., Kamradt, D.A., et al. (1999). Estimating population size by genotyping faeces. *Proceedings of the Royal Society of London Series B Biological Sciences.***266:** 657-363.
19. Larget, B. and Simon, D.L. (1999) Markov chain Monte Carlo algorithms for the Bayesian analysis of phylogenetic trees. *Molecular Biology and Evolution.***16:** 750-759.
20. Luikart, G., England, P.R., Tallmon, D., Jordan, S. And Taberlet, P. (2003). The power and promise of population genomics: from genotyping to genome typing. *Nature Reviews Genetics.***4:** 981-994.
21. Lundrigan, B.L., Jansa, S.A. and Tucker, P.K. (2002). Phylogenetic relationships in the genus Mus, based on paternally, maternally, and biparentally inherited characters. *Systematic Biology*. **51:** 410-431.
22. Lynch, M. (1996). A quantitative genetic perspective on conservation issues. In J. C. Avise and J. L.

Hamrick (eds) *Conservation genetics: case histories from nature*. Chapman & Hall, New York, pp 471–501.

23. Makova, K.D. and Li, W.H. (2002). Strong male driven evolution of DNA sequences in humans and apes. *Nature*.**416:** 624-626.
24. Manel, S., Berthier, P. And Luikart, G. (2002). Detecting wildlife poaching: Identifying the origin of individuals with Bayesian assignment tests and multilocus genotypes. *Conservation Biology*.**16:** 650-659.
25. Nikaido, M., Nishihara, H., Hukumoto, Y. and Okada, N. (2003) Ancient SINEs from African endemic mammals. *Molecular Biology and Evolution.***20:** 522-527.
26. Norman, J. A., Moritz, C. and Limpus, C. J. (1994). Mitochondrial DNA control region polymorphisms: genetic markers for ecological studies of marine turtles. *Molecular Ecology*.**3:**363–373.
27. Pfunder, M. Holzgang, O and Frey, J. (2004). Development of microarray-based diagnostics of voles and shrews for use in biodiversity monitoring studies, and evaluation of mitochondrial cytochrome oxidase I vs. cytochrome b as genetic markers. *Molecular Ecology*.**13:** 1277-1286.
28. Prakash, S. and Verma, A.K. (2022). Anthropogenic activities and Biodiversity threats. International Journal of Biological Innovations. 4(1): 94-103.
29. Ross, H.A., Lento, G.M., Dalebout, M.L., et al. (2003). DNA surveillance: web based molecular identification of whales, dolphins and porpoises. *Journal of Heredity*.**94:** 111-114.
30. Schemske, D. W., Husband, B.C., Ruckelshaus, M.H., *et al*. (1994). Evaluating approaches to the conservation of rare and endangered plants. *Ecology*.**75:**584–606.
31. Shedlock, A.M. & Okada, N. (2000). SINE insertions: powerful tools for molecular systematics. *Bioessays*.**22:** 148-160.
32. Valiere, N., Berthier, P., Mouchiroud, D. And Pontier, D. (2002). Gemini: software for testing the effects of genotyping errors and multitudes approach for individual identification. *Molecular Ecology Notes*.**2:** 83-86.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 29- 34|

Environmental Degradation and Human Health in Present Scenario

Seema Srivastava
Department of Education, Swami Vivekanand University, Sagar (M.P.)

Abstract

The detrimental consequences on human health are caused by environmental issues. Climate change, pollution, environmental degradation, and resource depletion may be the main environmental problems of the present. The environmental degradation has adverse impacts on microorganisms, plants, animals and human. Many of the problems we had were related to public health. It is simple to dispose of the rubbish in a trash container.The variety of life in the world or a specific habitat, or biodiversity, is declining. The overall levels of biodiversity have drastically decreased to a dangerousdegree. Contaminants include poisons, dangerous chemicals, and airborne pathogens can contaminate potable water. 780 million people are thought to be completely without access to potable water. India's Swachh Bharat Abhiyan is a nationwide initiative that will run from 2014 to 2019. The National Green Tribunal Act, 2010 (NGT) is an Act of the Indian Parliament that permits the establishment of a unique tribunal to handle the prompt resolution of matters involving environmental issues.

Keywords: Environmental degradation, Swachh Bharat Abhiyan, NGT, human health.

Introduction

Now-a-days most of the countries give a high value on leading healthy lives. Our modern human life is now characterised by stress, anxiety and depression. Modernization, urbanisation, and industrial activity have a profoundly negative impact on human life. Because of this, there are numerous fatal diseases that affect human life. If we examine the root cause of the issue carefully, we will discover that pollution has severely harmed the environment's ecosystem. In simple words we can say that many harmful or poisonous substance change the natural environment or polluted the environment. Undoubtedly, one of the largest issues the world is currently experiencing is environmental degradation (Hamsareni and Kanchana, 2019). It is a problem that affects our daily lives, physical health, and finances. Many creatures, including humans, can die as a result of air and water pollution in a given habitat.

Degradation of the environment has various negative implications on human health. For the sake of both the

environment and humans, environmental preservation is a necessity at the individual, corporate, and governmental levels (Alzira and Dinis, 2016). Climate change, pollution, environmental deterioration, resource depletion, and other pressing environmental issues may be mentioned[2]. Many conservation movements were started to safeguard endangered animals, ecologically important local natural resources, genetically modified foods, and global warming.

Many different ways that climate change is affecting people's livelihoods and health. Clean air, safe drinkable water, a plentiful supply of nutrient-rich food, and a secure place to live are all at risk, and it may undo decades of advancement in global health. Climate change is predicted to result in an extra 250 000 deaths annually between 2030 and 2050, just from malnutrition, malaria, diarrhoea, and heat stress[3]. By 2030, the direct health expenses are projected to be between USD 2-4 billion annually.The areas least able to cope without assistance to prepare and react will be those with weak health infrastructure, which is mostly in developing nations (Eccleston, 2010). In order to safeguard public health from climate change, how does WHO assist nations in constructing climate-resilient health systems and monitoring national progress?

Human health and wellbeing depend on a clean atmosphere. In addition, the local surroundings may contain stressors that are harmful to health, such as noise, hazardous chemicals, and air pollution. Through heatwaves, floods, and shifts in the distribution of vector-borne diseases, climate change also negatively impacts human health. More broadly, ecosystem functions like freshwater access and food production are threatened by climate change, biodiversity loss, and land degradation, which can have an adverse effect on human well-being.

It is now generally acknowledged that the climate change is occurring as a result of the accumulation of greenhouse gases brought on by the burning of fossil fuels. There are many ways that climate change may have an impact on health, including an increase in the frequency and severity of heat waves, a decrease in deaths from the cold, an increase in floods and droughts, changes in the distribution of vector-borne diseases, and impacts on the likelihood of disasters and malnutrition. The conditions for good health include clean air, a stable climate, enough water, sanitation and hygiene, safe chemical use, radiation protection, healthy and secure workplaces, sound agricultural practises, health-supportive cities and built environments, and preserved wildlife.

Waste Disposal

It is simple to dispose of the refuse in a trash can. Except when we gripe about the smell and other issues, we rarely give our neighbourhood landfills much thought. Disposing of waste endangers not only the planet and its ecosystem but also people and animals. When waste is disposed of via

burning it for examples Parali or nuclear it emits hazardous toxins in the air and difficulty in breathing.

Overpopulation

Carbon dioxide and other gases are released into the atmosphere by people who live on this planet. The growing population comes with the cost of greenhouse gasses and climate change. Until people understand that their actions directly contribute to these urgent environmental problems. Resources aren't always obtained sustainably, so we should consider that. Fortunately, reducing carbon pollution can be accomplished through the use of renewable energy. The required resources can be obtained sustainably by increasing the quantity of sustainable energy sources like wind and solar power.

Loss of Biodiversity

Both the health of our world and the welfare of humans depend on biodiversity. However, strain on nature is greater than ever. Our increasing demands for energy, more and more things, and our needs for food, water, and land are causing habitat destruction, polluting our air and water, and wiping out entire plant and animal species. The rate of biodiversity loss today is up to 10,000 times quicker than it was one hundred years ago.

The amounts of biodiversity have drastically decreased to a dangerous level. The World Wildlife Federation estimates that biodiversity has decreased by about 27% over the past three decades. Urban sprawl, deforestation, and climate change are just a few of the dangers putting biodiversity in danger (Ashok, 2021). The food chain, water sources, and other resources are at danger due to a lack of biodiversity. Ecosystems deteriorate until they are no longer there if there is not enough variety. The world cannot afford the cost of biodiversity loss. Biodiversity is necessary for ecological balance, sustainable development and human survival (Ashok, 2018; Verma, 2017, Verma, 2019). Things like airborne diseases, toxins, and dangerous substances can contaminate water. Millions of people still lack access to pure water. This is a not a problem of developing countries but also in developed countries.

Scarcity of Portable water

Contaminants like toxins, dangerous substances, and airborne micro-organism or spores can contaminate potable water. Contaminated waters are undrinkable. 780 million people have no access to potable water. Though, this isn't just an issue in underdeveloped countries. The 2017 California drought and the fact that Flint, Michigan hasn't had access to pure water in nearly four years are the ideal illustrations for demonstrating that water scarcity and pollution are issues not only abroad but also domestically. Your body contains a large amount of water, just like the Planet does. Both land and your body need clean water to survive.

Pollution

Pollution is defined as the introduction of any substance into the environment that are harmful to human and other living organism. These substance or pollutants may be harmful solids, liquids, or gases that harm our environment and are produced in greater quantities than normal.There are many types of pollution, including in the air, land, and water. The danger that pollution poses to the environment and to people is both present and future. Both the environment and humans are presently and in the future at risk from pollution[4]. The ozone layer is weakened by polluted air, and causes health issues. Habitats and irrigation are destroyed by contaminated soil. If pollution is present in the water, you drink or the in air you breathe, it will have a significant impact on our health. Only people are able to restore the environment and animals after pollution.

Deforestation

Deforestation is the source of greenhouse gas emissions, not automobiles or industries. By 2030, there may only be 10% of the original rainforests left because the remaining 90% have either been cleared for agriculture or harvested for timber or wood-based products. Forests are home to about 75% of all plant and animal types. Ecosystems will die as a result of the ongoing climate change. The number of plants still producing oxygen and removing carbon dioxide is decreasing. It is all due to deforestation. People often are unaware of the negative impacts of deforestation, so it is important to think about it.

Swachh Bharat Abhiyan

In order to spread awareness among people about the importance of cleanliness, the government of India has launched the Swachh Bharat Mission (SBM), Swachh Bharat Abhiyan, or Clean India Mission in 2014. It is a country-wide campaign initiated by Hon'ble Prime Minister Shri Narendra Modi Ji. Actually, it is a restructured version of the Nirmal Bharat Abhiyan launched in 2009 that failed to achieve its intended targets. The aim of this mission is to clean up the streets, roads, and infrastructure of India's cities, towns, and rural areas and also to improve solid waste management. So, this campaignis playing a crucial role toprotect the environment.

National Green Tribunal (NGT)

The National Green Tribunal (NGT) has been established on 18.10.2010 under the National Green TribunalAct, 2010for effective and expeditious disposal of cases relating to environmental protection and conservation of forests and other natural resources including enforcement of any legal right relating to environment and giving relief and compensation for damages to persons and property and for matters connected therewith or incidental thereto. It is a specialized body equipped with the necessary expertise to handle environmental disputes involving multi-disciplinary issues[7]. The Tribunal shall not be bound by the procedure laid down under the

Code of Civil Procedure, 1908, but shall be guided by principles of natural justice. It is based on Article 21 of the Indian Constitution, which guarantees the right to a healthy environment to all Indian citizens.

Public Health

Health is considered as wealth. An individual can only advance in life if they are in good health. The human organism has a unique maintenance system. The body is capable of making ongoing adjustments and holding those changes. "Homeostasis" is the name of this process. However, this mechanism could malfunction for a variety of causes, which would have an impact on a person's health. There is a direct correlation between health and environment because someone is said to be in good health if they can operate normally in a particular environment. Community health can be preserved if the environment is safeguarded and pollutant-free. Today, however, the environment's condition has declined, which is having an impact on community health.

We are currently dealing with public health-related problems. Overpopulation, water shortages, and pollution. The general health is clearly threatened by all of these. According to the WHO, unhealthful surroundings are directly responsible for almost one out of every four fatalities each year[3]. The growing anti-vaccination movement threatens public health even in industrialised nations, bringing back diseases like measles that had been virtually eradicated. Human health and wellbeing are major issues in today's society. Our health is greatly influenced by what we consume and how much air we absorb.

Conclusion:

All living organisms need healthy environment. An unhealthy environment possesses health hazards consequently a violation of the health. But the environment becomes polluted so man, plants and all other living animals also get affected.Because of overpopulation, poverty, illiteracy, lack of knowledge, and poor conditions, our environment is deteriorating day by day. This is right time to address these pressing issues in order to safeguard the environment because they cause numerous health issues and dangerous diseases like cancer, heart attacks, diabetes, high blood pressure, and skin diseases and so on. It is a need of today that we must make sincere efforts to control these major problems by:

- Raising public awareness of the need to protect the environment.
- Propre disposal of waste.
- Since education is the only means of solving any issue, we should concentrate on promoting environmental education among all people.
- Environmental Law should be implemented seriously and effectivelyto protect the environment.

References

1. Alzira, M. and Dinis, P. (2016. Environment and human health. Journal Environmental Pollution and human healt 9(2): 52-59.
2. Ashok, K.V. (2018). Ecological Balance: A Indispensable Need for Human Surviv Journal of Experimental Zoology, India. 2 (1): 407-409.
3. Ashok, K.V. (2021). Influence of clima change on balanced ecosystem, biodiversi and sustainable development: An overvie International Journal of Biologic Innovations. 3(2):331-337.
4. "Climate Change - Humanitarian Impac Archived from the original on 2016-04-0 Retrieved 29 June 2017.
5. "Climate Change - Threats and Solutions Archived from the original on 2016-04-0 Retrieved 29 June 2017.
6. Eccleston, Charles H. (2010). Global Environmental Policy: Concepts, Principles, and Practice. Chapter 7. ISBN 978-1439847664.
7. https://en.wikipedia.org/wiki/Swachh_Bharat_Mission
8. Hamsareni, C and Kanchana, D. (2019). The Impact of Environmental degradation on human health. JETIR, 6(5):81-84.
9. https://www.greentribunal.gov.in/
10. Verma, A.K. (2017). Necessity of Ecological Balance for Widespread Biodiversity. Indian Journal of Biology. 4(2): 158-160.
11. Verma, A.K. (2019). Sustainable Development and Environmental Ethics. International Journal on Environmental Sciences. 10 (1): 1-5.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 35 - 42|

Study the ethnic variation through morphological variable of crease form of radial longitudinal crease among the males of different populations.

Anjali Pandey
Department of Sociology, Faculty of Arts and Humanities
Mahakaushal University, Jabalpur (M.P.)
Corresponding author: pandeyanjali1213@gmail.com

Abstract

The palmar and finger prints are unique to individuals and play an important role in the personal identification. These traits are going to develop in early embryo face. The dermal ridges differentiate during the third and fourth month of pregnancy, while the flexion creases are seen/differentiate during the second and third month of pregnancy. Therefore, a pregnant woman exposed to environmental pollutants during the first half of her pregnancy may alter the dermatoglyphics of her fetes. The present attempt is to study the ethnic variation through Morphological variable of crease form of Radial Longitudinal Crease among the males of different populations. For which 150 males from each population likewise Brahmins, Gonds and Kacchis was examined. For analyzing the radial longitudinal creases, morphological variable was applied. The values are quantitative in nature so that for statistical interpretation chi-square test is applied. The various types of Radial Longitudinal flexion creases show significant value of chi-square among the Brahmins, Gonds and Kacchi, males' population and showing the ethnic variation as well.

Keywords: Morphological variable, Radial longitudinal crease, Environmental pollutant.

Introduction

Palmar flexion creases are not the sole representative of crease science. Palmar creases in fact, are the components of entire dermatoglyphic region and should not be treated as indiscrete units of non-biological aspects. Instead, a uniform approach is recommended. The present work is an attempt towards this direction. Achs et al. (1966, 67) asked that "The clinical significance of palmar crease abnormalities is being increasingly recognized. Unusual palmar creases have been reported in a wide variety of clinical disorders caused by various genetic and/or environmental factors where the insult occurs early in pregnancy."

According to Cron (1996) "Palmar creases as a viable method of personal identification have been the subject of research, study and technical papers. Palmar flexion creases can be used in the identification process. Since the late 19th century, both intentionally and by chance, the research and development of friction ridges as a means of personal identification has paralleled that of palmar creases due to their similarity in intrauterine formation and proximity to one another on human skin. Palmar crease individuality has been with us all time, but just recently has been recognized and understood."

Rawat and Bali (1970) studied in detail the attributes of crease morphogenesis among Criminals on the basis of crease surface area, crease transversality crease length, crease breadth and position of base point etc.

Gulekci (2021) also studied the effect of Environmental factors on finger prints development. Ahuja and Plato (1990) make a study on the effect of environmental pollutants on Dermatoglyphics patterns.

Ito et al. (1956) studied transverse creases among the Japanese population. Lestrange (1969) studied the frequency of transverse palmar creases in European population. Chamla and Sahley (1973), investigated transverse crease in Tunisian population., Osunwoke et al (2010), Adetona et al (2012), Uko et al. (2012*), Adetona* (2014*),* Sharma and Pandey (2015), Pandey and Sharma (2015) and so many scholars and researcher studied the ethnic variation of palmar flexion creases.

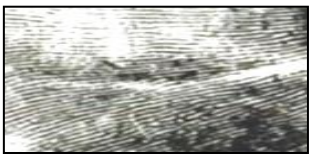
Materials and Method

The method for taking palmar prints and obtaining good results. The method suggested by Cummins and Midlo (1961) has been fully fallowed. The study is only concerned with examination of Radial Longitudinal creases of Brahmins, Kacchis and Gonds. From each population 150 males are selected randomly.The study is conducted in Dhana, Kadta, Pipariya and Chandrapura villages of Rahli block, Sagar district of Madhya Pradesh. For the test of significancy chi-square test has been used.

For analyzing the Radial Longitudinal creases, the morphological variables given by Bali and Rawat (1980) is applied, in their article introduce the attributes of creases in a systematic manner.

Crease Form: On the basis of crease anatomy, we can differentiate creases in to three forms: true creases, pseudo creases, and mixed creases.

True Crease



Pseudo Crease

Mixed Crease

Result and Discussion: The result related to ethnic variation of Crease form of Gonds, Brahmins and Kacchis males are presented in the following tables:

Table 1. Showing the ethnic variation of radial longitudinal creases of crease form among Brahmins and Gonds right hands of males.

S.no.	Crease types	Brahmin's males Rt hand		Gonds males Rt hand	
		Ab.	Pc.	Ab.	Pc.
1.	True	44	29.33	55	36.67
2.	Pseudo	42	28.00	27	18.0
3.	Mixed	64	42.67	68	45.33
Total		150	100.00	150	100.00

Rt- Right hand, Lt – Left hand, *df- degree of freedom, *p- Level of significant

χ^2= 4.63, p>0.05, df=2,(insignificant)

Table.1 shows frequency ethnic variation of radial longitudinal creases of form among right hands of Gonds and Brahmin males. It may be observed from the table that mixed typed of crease form shows higher frequency among Brahmins (42.67) and Gonds (45.33), while the pseudo type of crease form shows lowest frequency among Brahmins (28.0), and Gonds (18.0).

It may be concluded that mixed type of crease form shows higher frequency among Brahmins and Gonds males and shows insignificant ethnic variation.

Table 2 Showing ethnic variation of radial longitudinal crease of crease form among Gonds and Kacchis right hands of males.

S.no.	Crease types	Kacchis males Rt hand		Gond males Rt hand	
		Ab.	Pc.	Ab.	Pc.
1.	True	31	20.67	55	36.67
2.	Pseudo	52	34.67	27	18.00
3.	Mixed	67	44.66	68	45.33
Total		150	100.00	150	100.00

Rt- Right hand, Lt – Left hand, *df- degree of freedom, *p- Level of significant

χ^2=14.84, p<0.05, df=2,(significant)

Table 2 shows frequency distribution of radial longitudinal crease of form among Kacchis and Gonds right hands of males. It could be seen from the table that mixed type of crease shows higher frequency among Kacchis (44.56), and Gonds (45.33), while the true type of crease form shows lowest frequency among Brahmins (20.67), and among the Gonds pseudo type of crease form shows lowest frequency. It may be concluded that mixed type of crease form shows

higher frequency among Kacchis and Gonds and shows significant ethnic variation.

Table 3 Showing ethnic variations of radial longitudinal creases of crease form among Brahmin and Kacchis right hands of males.

S.no.	Crease types	Brahmin's males Rt hand		Kacchis males Rt hand	
		Ab.	Pc.	Ab.	Pc.
1.	True	44	29.33	31	20.67
2.	Pseudo	42	28.00	52	34.67
3.	Mixed	64	42.67	67	44.66
Total		150	100.00	150	100.00

Rt- Right hand, Lt – Left hand, *df- degree of freedom, *p- Level of significant

χ^2= 3.4, p>0.05, df=2,(insignificant)

Table 3 shows frequency distribution of radial longitudinal crease of form among Brahmins and Kacchis male's right hands. It may be observed from the table that mixed type of crease shows higher frequency among Brahmins (42.67) and Kacchis (44.56), while the pseudo type of crease form shows lowest frequency among Brahmins (28.0) and among the Kacchis (20.67) true type of crease form shows lowest frequency.

It may be concluded that the mixed type of crease presents higher frequency among Brahmins and Kacchis and shows insignificant ethnic variation.

Table 4 Showing ethnic variation of radial longitudinal crease of crease form among Brahmin and Gonds left hands of males.

S.no.	Crease types	Brahmin's males Lt hand		Gond males Lt hand	
		Ab.	Pc.	Ab.	Pc.
1.	True	44	29.33	52	34.67
2.	Pseudo	49	28.00	33	22.00
3.	Mixed	57	42.67	65	43.33
Total		150	100.00	150	100.00

Rt- Right hand, Lt – Left hand, *df- degree of freedom, *p- Level of significant

χ^2= 4.33, p>0.05, df=2,(insignificant)

Table 4 shows frequency distribution of radial longitudinal crease of farms, among Brahmins and Gonds left hands of males. It may be observed from the table that mixed type of crease form shows higher frequency among Brahmins (36.0) and Gonds (43.33), while the type of crease from shows lowest frequency among Brahmins (29.33) and among the Gonds (22.0) pseudo type of crease form shows lowest frequency.

It may be concluded that mixed type of crease form shows of higher frequency among Brahmins and Gonds and shows insignificant ethnic variation.

Table 5 Showing ethnic variation of radial longitudinal crease of crease form among Gonds and Kacchis left hands of males.

Table 5 shows ethnic variation of radial longitudinal crease of form among Kacchis and Gonds left hands of males. It could be seen from the table that mixed type of crease shows higher frequency among Kacchis (48.0) and Gonds (43.33), while the lowest frequency is shown by true type of

crease form among the Kacchis (16.67) (16.67) and among the Gonds (22.0) pseudo type of crease from shows lowest frequency.

S.no.	Crease types	Kacchis males Lt hand		Gond males Lt hand	
		Ab.	Pc.	Ab.	Pc.
1.	True	28	18.67	52	34.67
2.	Pseudo	50	33.33	33	22.00
3.	Mixed	72	48.00	65	43.33
Total		**150**	**100.00**	**150**	**100.00**

Rt- Right hand, Lt – Left hand, *df- degree of freedom, *p- Level of significant

χ^2= 14.61, p<0.05, df=2,(significant)

It may be concluded that the mixed type of crease form shows lowest frequency among Kacchis and Gonds, and also shows the significant ethnic variation.

Table-6 Showing ethnic variation of radial longitudinal crease of crease form among Brahmin and Kacchis left hands of males.

S.no.	Crease types	Brahmin's males Lt hand		Kacchis males Lt hand	
		Ab.	Pc.	Ab.	Pc.
1.	True	44	29.33	28	18.67
2.	Pseudo	49	28.00	50	33.33
3.	Mixed	57	42.67	72	48.00
Total		**150**	**100.00**	**150**	**100.00**

Rt- Right hand, Lt – Left hand, *df- degree of freedom, *p- Level of significant

χ^2= 6.34, p<0.05, df=2,(significant)

Table6 shows ethnic variation of radial longitudinal crease of form among Brahmins and Kacchis left hand of males. It could be seen from the table that mixed type of crease shows higher frequency among Brahmins (38.0) and Kacchis (48.0). While the true type of crease form shows lowest frequency among Brahmins (29.33) and Kacchis (16.67).

It may be concluded that the mixed type of crease form shows higher frequency among Brahmins and Kacchis and shows significant ethnic variation.

Table-7 Showing ethnic variation of radial longitudinal crease of crease form among Brahmin and Gonds both (rt+lt) hands of males.

S.no.	Crease types	Brahmin's males both (rt+lt) hand		Gond males both (rt+lt) hand	
		Ab.		Ab.	Pc.
1.	True	88	29.33	107	35.67
2.	Pseudo	91	30.33	60	20.00
3.	Mixed	121	40.33	133	44.33
Total		**300**	**100**	**300**	**100**

Rt- Right hand, Lt – Left hand, *df- degree of freedom, *p- Level of significant

χ^2= 8.83, p<0.05, df=2,(significant)

Table 7 shows ethnic variation of radial longitudinal crease of form among Brahmins and Gonds both hands (Rt+Lt) of males. It can be seen from the table that mixed type of crease form shows higher frequency among Brahmins (40.33) and Gonds (44.33), while the true type of crease shows lowest frequency among Brahmins (20.33) and

among the Gonds (20.0) pseudo type of crease form shows lowest frequency.

It may be concluded that mixed type of crease form shows higher frequency among Brahmins and Gonds and shows significant ethnic variation.

Table 8 Showing ethnic variation of radial longitudinal crease of crease form among Kacchis and Gonds both (rt+lt) hands of males.

S.no.	Crease types	Kacchis males both (rt+lt) hand		Gond males both (rt+lt) hand	
		Ab.	Pc.	Ab.	Pc.
1.	True	59	19.67	107	35.67
2.	Pseudo	102	34.00	60	20.00
3.	Mixed	139	46.33	133	44.33
Total		300	100	300	100

Rt- Right hand, Lt – Left hand, *df- degree of freedom, *p- Level of significant

χ^2= 25.23, p<0.05, df=2,(significant)

Table 8 showing ethnic variation of radial longitudinal crease of form among the Kacchis and Gonds both hands (Rt + Lt) of males. It may be observed from the table that mixed type of crease form shows highest frequency among Kacchis (46.33) and Gonds (44.33). While the lowest frequency is shown by true type of crease among Kacchis (19.67), and among the Gonds (20.0) pseudo type of crease form shows lowest frequency.

It may be concluded that mixed type of crease form shows higher frequency among Kacchis and Gonds and shows significant ethnic variation.

Table 9 Showing ethnic variation of radial longitudinal crease of crease form among Brahmin and Kacchis both (rt+lt) hands of males.

S.no	Crease types	Brahmin's males both (rt+lt) hand		Kacchis males both (rt+lt) hand	
		Ab.	Pc.	Ab.	Pc.
1.	True	88	29.33	59	19.67
2.	Pseudo	91	30.33	102	34.00
3.	Mixed	121	40.33	139	46.33
Total		300	100.00	300	100.00

Rt- Right hand, Lt – Left hand, *df- degree of freedom, *p- Level of significant

χ^2= 7.63, p<0.05, df=2,(significant)

Table 9 showing ethnic variation of radial longitudinal crease of form among Brahmins and Kacchis both hands of males (Rt+Lt). It may be observed from the table that mixed type of crease form shows higher frequency among Brahmins (40.33) and Kacchis (46.33). The true type of crease form shows lowest frequency among Brahmins (29.33) and Kacchis (19.67).

It may be concluded that the mixed type of crease form shows higher frequency among Kacchis and Brahmins and shows significant ethnic variation.

5. Summary and Conclusion:

1. The mixed type of crease form of radial longitudinal crease showing higher frequency among the three populations i.e., Brahmins, Gonds and Kacchis in males.

2. The mixed type of crease form of radial longitudinal crease of right hand among Brahmins & Kacchis, and,

Brahmins & Gond males showing insignificant ethnic variation, while the Kacchis & Gonds are showing significant value among the males.

3. The mixed type of crease form of left hands showing higher frequency of radial longitudinal crease among the three populations i.e., Brahmins, Gonds and Kacchis in males.

4. The radial longitudinal creases of left hands of the crease form among the Brahmins & Gonds are showing insignificant result among the males, while the Brahmins & Kacchis, and the Kacchis & Gonds are showing significant result among the males left hands.

5. The mixed type of crease form of left hands of radial longitudinal crease among the three populations i.e., Brahmins, Gonds and Kacchis among the female's significant ethnic variation.

6. The crease form of both hands (rt+lt) of radial longitudinal crease showing significant ethnic variation among males of all the three populations.

The morphological variable crease form of radial longitudinal crease is exhibiting significant value of chi-square among Brahmins, Kacchis and Gonds. It shows that they have ethnic variation.

6. References:

1. Ahuja, Y.R., Plato, C.C. (1990). Effect of Environmental Pollutants on Dermatoglyphics Patterns In: Durham, N.M., Plato, C.C. (eds) Trends in Dermatoglyphic Research. Studies in Human Biology, vol 1. Springer, Dordrecht.
2. Pandey, Anjali and Sharma, A.N. (2015): The study of transverse flexion crease among Lodhi's of Sagar District (Madhya Pradesh), India, Int. Jour. of Innovation and Scientific research, Vol. 14, 2, 224-227
3. Gülekçi, Y. (2021). Effects of Environmental Factors on Fingerprint Development European Journal of Science and Technology, (32), 463-470.
4. Chamla, M.C. and A. Sahley (1973) : Le pli palmaire transverse chez (les tunisiens). L' Anthropologie (Paris) 77 (1-2): pp, 107-118.
5. Adetona, M.O., Oladapo, O.O. and Akinyemi, J.O. (2012): Palmar flexion creases variants among Nigerians, Agr. J.Biomed. Res. Vol. 15, 93-96.
6. Adetona, O. Moses (2014): Volar digital transverse creases of the Nigerians, Jour. of Bio. Agri. and Health care, Vol. 4, 2224-3208.
7. Lestrange, M.de (1969): The transverse crease in Europe-index ans compative study of different samples cited in the literature. American journal of Physical Anthropology, 30: pp 173-182.
8. K.T., Kogata, M. Murai, H. Osugi (1956): The transverse crease among the Japanese. Classification of Affenfurche among the Japanese. Transactions of Tottori University (Department of Anatomy), 4.

9. Rawat, S.K. (1980) : The study of palmar Dermatoglyphic and palmar creases among murders. Human Biology: Recent Advances 2 : 401-415.

10. Pandey, A. and Sharma, A.N. (2015): Study of longitudinal palmar flexion crease among Lodhi's of Sagar District. Asian Jour. of Multi-

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 43 - 46|

Biodiesel: An Eco-friendly Renewable Alternative of Conventional Diesel

Jitendra Kumar and Rishi Ranjan Pandey*

Department of Chemistry, M. L. K. (P.G.) College, Balrampur (U.P.)

*Corresponding author: *prr.panday@gmail.com*

Introduction:

Energy is one of the basic requirements in the contemporary era which is the foundation for the industrial development and modern life style of human race. The nation's progress is significantly influenced by its ability to access energy in an economical manner. Fossil fuels are formed from the decomposition of buried animals and plants under geothermal conditions that died millions of years ago and it currently supplies around 80% of the world's energy needs. They are found as carbon-rich deposits beneath the earth surface that are extracted and utilized for energy production. However, these resources are non-renewable and are depleting rapidly.

Currently, the most important energy resources in the world are fossil fuels which encompass crude oil, coal, and natural gas. Global petroleum (oil and gases) uses has consistently increased over the past three decades, leading to greater living standards, more mobility, and more industrialization and application of other petrochemicals. With a 30.95% share of the world's total primary energy consumption, petroleum ranks among the top energy source. The consumption of petroleum has increased at a 0.7% annual growth rate from 2011 and 2021 and at 6% in 2021 alone. Unfortunately, no significant new petroleum discoveries have been made in the recent decades. It is causing the net world petroleum reserves to gradually decline. Subsequently, the price of petroleum, which has historically been quite volatile, is actually rising on the global market. Over the past 35 years, the price of crude oil has climbed by over 426% on average which is a cause of great concern for developing nations due to economical burden [1]. Moreover, burning of petroleum and other fossil fuels contributes significantly in total carbon emission in the atmosphere along with other poisonous gases such as oxides of nitrogen and sulphur. A few of the detrimental environmental consequences of the expanding production and uses of fossil fuels in many nations include global warming, unpredictable weather pattern, air pollution, and increased health risks [2]. That is why, the world is being forced to reduce its reliance on petroleum and turn more and more towards clean and renewable sources of energy. Around the world, there are numerous efforts being made to replace petroleum with renewable resources such as solar energy, wind energy, hydro electrics, geothermal, tidal etc.

Biodiesel: An alternative of conventional Diesel

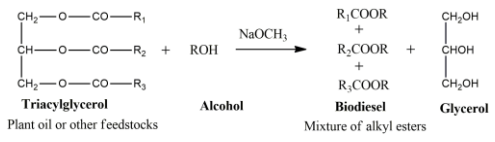
Diesel is obtained from fractional distillation of crude petroleum and is used heavily in machinery with internal combustion engines such as automobile, farming and industrial equipment. A substitute fuel that is similar to regular diesel is biodiesel with potential to be used in compression ignition engines (diesel engines). The National Soy Diesel Development Board in the US initially used the term "biodiesel" in 1992 to market and promote this product [3]. The main ingredients used to make it are pure vegetable oil, animal fat, tallow, non-edible plant oil, and used cooking oil. The raw materials for production of biodiesel are not costly.

It is biodegradable, non-toxic and being free of sulphur and aromatics making it more advantageous over the conventional petrol and diesel. It also produces less carbon monoxide, hydrocarbons, smoke and particulate matters on burning reducing the carbon foot print. It emits fewer greenhouse gases and air pollutants. It is also safer to handle than conventional diesel with higher flashpoint. Further benefits of biodiesel over normal petrol and diesel that are worth highlighting are its biodegradability and intrinsic lubricity. However, the main drawbacks of using biodiesel as an alternative fuel resource include its greater cost of manufacturing, lower energy content when compared to fossil diesel, and ability to emit nitrogen oxide when burned [4].

Synthesis and Constituents of Biodiesel:

Biodiesel is mono-alkyl esters of long-chain fatty acids, derived from renewable vegetable oils or animal fats. The starting material of biodiesel is plant oils or related products mainly composed of triglycerides of long chain fatty acids. Aliphatic chain present in triglycerides may be saturated or unsaturated. Biodiesel is synthesised by transesterification of these materials with methanol or other monohydric alcohols in presence of sodium methoxide ($NaOCH_3$) as catalyst (Fig 1) [5].

Biodiesel is obtained from vegetable oils (edible or non-edible oils), animal fats, and used waste cooking oil such as soybean oil, rapeseed oil, corn oil, cottonseed oil, olive oil, palm oil, peanut oil, safflower oil, Karanja oil, Jatropha oil, tallow etc. [6].



R_1, R_2, R_3 represnt alkyl chains and may be same or different, R= CH_3

Fig 1: Transesterification of plant or related oils

Elemental and chemical composition of biodiesel is compared with conventional diesel and is depicted in Table 1. Due to absence of aromatic compounds and naphthenes (cycloalkanes), it is less toxic than diesel. Because biodiesel contains the electronegative element oxygen, it is slightly more polar than diesel fuel and has a higher viscosity. When compared to diesel fuel, the presence of elemental oxygen reduces the heating value of

biodiesel. Presence of nitrogen in it, on the other hand makes less eco-friendly as for as emission of nitrogen oxides is concerned. In terms of emissions of carbon monoxide, total unburned hydrocarbons, particulate matter, sulphates and air toxics mutagenicity, it ranks better than conventional diesel [6].

Table 1: Constituents of Biodiesel and conventional diesel

Elemental Constituents	% Composition	
	Biodiesel	Diesel Fuel
Carbon	79.6	86.4
Hydrogen	10.5	13.6
Oxygen	8.6	6.5
Nitrogen	1.3	–

Chemical Constituents	% Composition	
	Biodiesel	Diesel Fuel
n-Aliphatics	15.2	67.4
Olefinics	84.7	3.4
Aromatics	-	20.1
Naphthenes	-	9.1

Uses and Future Prospective of Biodiesel:

For usage in diesel engines, biodiesel can be used as pure fuel or blended with petroleum-based diesel at any ratio. The most popular biodiesel mixtures are B2 which contains 2% biodiesel and 98% petroleum fuel; B5 which contains 5% biodiesel and 95% petroleum diesel; and B20 which contains 20% biodiesel and 80% petroleum diesel. Blends of biodiesel and petroleum diesel have a number of technical drawbacks, including issues with fuel freezing in cold temperatures, a lower energy density, and fuel degradation when stored for extended periods of time. In addition to being compatible with the majority of storage and distribution systems, biodiesel blends up to B20 can be utilised in almost all diesel equipment. In most cases, low-level blends don't need for any engine modifications. Certain engines can operate with higher blends including B100 (pure biodiesel) with little to no modification, however for B100 transportation and storage require special management [6].

Even in the USA, which continues to be the world's top producer, the cost of biodiesel synthesis makes it impossible to profit from its production. The primary raw material for the production of biodiesel in the United States, Brazil, and Argentina is soybean oil, which has a fairly low oil yield of 18%. The predominant biodiesel feedstock in Europe is rapeseed, which makes the production process much more expensive than in the aforementioned nations [3]. Research needs to done to find out solutions related to problems associated with the production, cost reduction, engine modification and storage and transportation of pure biodiesel. In the future, with the advancement of technology, biodiesel could be used as source of renewable energy with environmental compatibility. It will lead to sustainable eco-friendly

development with environmental ethics [7].

References:

1. J. Hill, E. Nelson, D. Tilman, S. Polasky, and D. Tiffany, "Environmental, economic, and energetic costs and benefits of biodiesel and ethanol biofuels," *Proc. Natl. Acad. Sci. U. S. A.*, vol. 103, no. 30, pp. 11206–11210, 2006, doi: 10.1073/pnas.0604600103.
2. H. Hou, W. Lu, B. Liu, Z. Hassanein, H. Mahmood, and S. Khalid, "Exploring the Role of Fossil Fuels and Renewable Energy in Determining Environmental Sustainability: Evidence from OECD Countries," *Sustainability*, vol. 15, no. 3, p. 2048, 2023, doi: 10.3390/su15032048.
3. F. Akram *et al.*, "Current trends in biodiesel production technologies and future progressions: A possible. displacement of the petro-diesel," *J. Clean. Prod.*, vol. 370, p. 133479, Oct. 2022, doi: 10.1016/j.jclepro.2022.133479
4. S.N. Gebremariam and J.M. Marchetti, "Economics of biodiesel production: Review," *Energy Convers. Manag.*, vol. 168, no. February, pp. 74–84, 2018, doi: 10.1016/j.enconman.2018.05.002
5. G. Knothe and L. F. Razon, "Biodiesel fuels," *Prog. Energy Combust. Sci.*, vol. 58, pp. 36-59, 2017, doi:10.1016/j.pecs.2016.08.001.
6. M. Balat and H. Balat, "Progress in biodiesel processing," *Appl. Energy*, vol. 87, no. 6, pp. 1815–1835, 2010, doi: 10.1016/j.apenergy.2010.01.012.
7. A. K. Verma Sustainable Development and Environmental Ethics. *International Journal on Environmental Sciences.* 2019.10 (1): 1-5.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 47 - 52|

Holy Tree Neem: Boon for Mankind

Devendra Swaroop[1]*, Vikash Ranjan Chaudhury[1] and Alka Katiyar[2]
CSA University of Agriculture & Technology, Kanpur (U.P.), India
[1]Krishi Vigyan Kendra, Mainpuri (U.P.)
[2]Krishi Vigyan Kendra, Fatehpur (U.P.)
*Corresponding author: dswaroopcsa@gmail.com

Abstract

The most popular and beneficial tree since ages Neem (*Azadirachta Indica*) is a large evergreen tree under family Meliaceae. It is one of the two species in the genus *Azadirachta*, it is a native of the Indian subcontinent and most of the countries in Africa. A very common and worthy eco friendly, popular for its medicinal values, neem is used in several manners, almost every part of the tree i.e. leaves, twigs, fruits, flowers, seeds and bark is utilized. Its role as health- promoting effect is attributed because; it is rich source of antioxidant. It has been widely used in Chineese, Ayurvedic and Unani medicines worldwide, especially in Indian subcontinent for the treatment and prevention of several diseases. Earlier findings confirmed that neem and its constituents play role in the scavenging of free radical generation and prevention of disease pathogenesis. It contains around one thousand chemicals out of which more than hundred are terpinoids. Neem kernels contain 30-40% oils, 2.5 to 3.0% teripinoids and 0.2-0.65 azadiractin.

Keywords: *Azadiractin,* Ayurveda, Disease, Environment, Neem, Abhiyan, Terpinoids.

Introduction:

India is bestowed with multi-climatic blessings in the world which is very conducive for the cultivation of varieties of flora and fauna (Singh and Sharma, 2007). Neem (*Azadirachta indica*) commonly known as Bead tree, Holy tree, Margosa, Nim, Nimba, Persian lilac, Pride of China, Neem, Nimtree or Indian Lilac, is a tree of the family Meliaceae. It is one of the two species in the genus *Azadirachta*, and is a native of the Indian subcontinent and most of the countries in Africa. It is typically grown in tropical and sub-tropical regions such as India. The neem tree most popular for its medicinal values (Arya, 2019) has yellow coloured, fruits with a single seed, it can become very tall very fast, and grows best in warm temperatures.

A neem tree also grows on islands in southern Iran. Neem contains chemicals that might help reduce blood sugar levels, heal ulcers in the digestive tract, prevent pregnancy, kill bacteria and prevent plaque forming in the mouth. People use neem for lice, tooth plaque, gingivitis, and psoriasis, to repel insects and for many

other purposes, but there is no good scientific evidence to support using neem for COVID-19. Neem fruits and seeds are the source of neem oil which is used as a pesticide.

The science of ayurveda and the use of plants for treating human being as well as livestock with the plants are well known (Swaroop *et al.,* 2007; Pandey, 2019; Prakash and Verma, 2021; Jafri and Mishra, 2022). As per the Ayurvedic medical literatures / texts it is very clearly mentioned that every part of miraculous neem tree has health promoting benefits, therefore the rural mass / population has used Neem safely and effectively for more than last 5000 years. Thus, the people of India refer it as "The Village Pharmacy", and in some parts also called as the Holy Tree-corelated with Sheetla Maata.

The neem tree is a fast growing tree that grows best in semi arid tropical regions, usually flowers in March-April. Several traditional medicines are made with the leaves, root, seeds and barks (Swaroop *et al.,* 2022). The fresh juice of leaves is beneficial in typhoid, urinary disorders, leprosy, intestinal worms, jaundice, skin problems and several other diseases. Soft twigs are used as brush for teeth cleaning.

Today, neem has once again become an agro-scientific celebrity, as it has figured as the priority in seminars and several agricultural workshops all over the world. Modern western medicine is discovering the importance of neem which the ancient Indians have known for thousands of years, that the neem tree has superb pharmaceutical and pesticidal qualities. Its effectiveness, availability and safety have made agro-scientists promote cultivation of neem forests. The azadirahcton compound in neem has been recognized as an effective insecticide that is biologically selective, non-harming to the useful pest- predators, but keeps almost two hundred fifty harmful ones at bay (Singh and Vaish, 2017). Scientists have recommended coating urea with neem cake to kill the nitrifying bacteria.

Looking at the tremendous increase of population in the country, our compulsion would be not only to stabilize the agricultural production but to increase it further in eco friendly and sustainable manner (Verma, 2019). In this "Back to Nature" healthcare mindset it is extremely relevant that we not only conserve our herbal biodiversity but also cultivate it for adequate utilization by the industries to meet the domestic as well as exports demand sustainably with quality standards. (Khanuja, 2007).

Use of Neem

A very common and worthy eco friendly tree Neem, is used in several manners, almost every part of the tree i.e. leaves, twigs, fruits, flowers, seeds and bark is utilized. It contains around one thousand chemicals out of which more than hundred are terpinoids. Neem kernels contain 30-40% oils, 2.5 to 3.0% teripinoids and 0.2-0.65 azadiractin. In ancient times neem was the most celebrated medicinal tree of India and has secured its place in number of pauranic texts like Atharava veda, Upanivhod, Amarkosha and Ghrysutra, these all dealt

with the outstanding qualities of the neem tree as a source of medicinal and a natural pesticide.

People use neem for lice, tooth plaque, gingivitis, and psoriasis, to repel insects and for many other purposes, but there is no good scientific evidence to support using neem for COVID-19. Neem fruits and seeds are the source of neem oil which is used as a pesticide. It contains around one thousand chemicals out of which more than hundred are terpinoids. Neem kernels contain 30-40% oils, 2.5 to 3.0% teripinoids and 0.2-0.65 azadiractin. Neem oil is used for soap and Pharmaceutical products now days, neem based products are widely used in organic farming, still dried leaves are used for safe grain storage in rural areas. The seed material of pulses were protected from store grain insects by use of non-edible oil of neem kernels @ 5ml./kg of seed (Vashishta *et al.,* 2017). The bark is used for controlling malaria, stomach and intestinal ulcers, skin diseases, pain and fever. The flower is used for reducing bile, controlling phlegm and treating intestinal worms. The fruit is used for hemorrhoids, intestinal worms, urinary tract disorders, bloody nose, phlegm, eye disorders, diabetes, wounds and leprosy. New tender twigs are used for cough, asthma, hemorrhoids, intestinal worms, low sperm levels, urinary disorders and diabetes.

The seed and neem oil is used for leprosy and intestinal worms. They are also used for control of birth and cause abortion. The stem, root bark and fruits are used as tonic and astringent. Some people apply neem directly to the skin to treat head lice, skin diseases. Wounds skin ulcers, as a mosquito repellant and as a skin softner, neem is used inside the vagina for birth control.

Neem for Health:

The most important parts of the neem tree are the bark, leaves, seed and kernels; they contain compounds known as alkaloids and limonoids, which have proven antiseptic, antiviral, antipyretic, anti-inflamatory, anti-ulcer and anti fungal (Singh and Vaish, 2017). Eating 8-10 fresh leaves in morning develops resistance power in body. Herbalists also use neem oil derived by crushing the seeds, to treat skin problems, head lice and dandruff. It creates a purifying effect when used in aromatherapy.

Neem as a Medicine:

Well known for its magical effects on the skin, neem leaves effectively treats eczema, ringworm and acne. If taken orally the leaves have astringent qualities, remove toxins from the body, purify the blood and neutralize the damaging free radicals. Modern scientists have found even more uses of this remarkable tree. The seeds, bark and leaves contain compounds with proven antiseptic, antiviral, antipyretic, anti- inflammatory, anti ulcer and anti fungal uses. Fumigation with neem leaves is effective as mosquito repellant.

Use of Neem in Agriculture and Livestock:

Bio pesticides and Botanical insecticides are ecologically and environmentally safer, generally affect the behavior and physiology of insects rather than killing

them (Vishwakarma, 2020). Among them Neem has justifiably received the maximum attention.

All the parts of neem tree possess insecticidal property but seed kernel is the most active. In the era of organic / natural farming neem based insecticides / pesticides are very effectively used to control insect and pests in several crops. Scientists have recommended coating urea with neem cake to kill the nitrifying bacteria. Neem coated urea introduced by IFFCO has given encouraging results and gained popularity.

The use of medicinal plants in solving the health ailments is based on long experiences, transmitted from ancestors to descendants and are still being used by the people as per their need, resource availability and agro-ecological situations (Prasad and Singh, 2017). Neem based products are widely used for our livestock health and hygiene; It heals the injuries, protects the environmental pollutions, provides fuel, timber and fodder.

Several neem based preparations, creams and lotions are effectively used for treating wounds and injuries, control of internal as well as external parasites. During the out breaks of FMD neem leaves are tied in the foot of livestock in order to control the spread of disease. Farmers make small pills of green leaves, and feed to calves at proper intervals for the control of round worms. Green leaves in some areas are fed to livestock specially goats, camels and sheep. Dry/semi dry leaves are usually burned for making smokes which safely repels, the mosquitoes and flies in the cattle sheds and houses as well.

Neem in Medicine:

Neem has been an indispensible part of our home remedies for ages; it has always been and still is a crucial component of domestic remedies. Even the shade of the neem tree is considered very healthy and due to its medicinal values plantation of neem tree in front of houses is strongly recommended. In fact it is still very common custom in some places in India, when a mother leaves a baby unattended she leaves a small twig of neem leaves near the baby for protection.

Some people are in the habit of chewing few tender neem leaves early in the morning empty stomach either daily or occasionally. Some of the common uses of neem in medicine are mentioned here , with the limits of self help should be kept in mind and special caution should be observed while treating children, pregnant and lactating women, convalescent individuals and senior citizens. If the problem is persistent or the symptoms are aggravated, immediate expert help should be taken.

Preventive use of Neem:

It serves in building immunity and preparation of tooth powder.

Curative Uses of Neem:

In hair care, conjunctivitis, ear drop, jaundice, stomatitis, Worms, stomach pain, urinary stones, urticaria, piles, pruiti,

fistula in anus, dysmenorrhoea, post-delivery care, skincare, psoriasis, sweating, burnings, chicken pox, measles, etc.

Side Effects of Neem:

1. Breathing problems or tightness in throat or chest**.**
2. Chest pain.
3. Skin hives, rash or itching or swollen skins.

Stop taking neem medicines right away, consult doctor if any of the above side effects are noticed, means one is allergic to it.

Precautions:

1. Pregnant and breast-feeding ladies should consult doctor before consuming neem.
2. Taking / consuming large amount of neem seeds may be unsafe.
3. Never give neem to infants and children, as it may cause serious side effects in them, like seizures, coma and even death.

Conclusion:

In this "Back to Nature" healthcare mindset it is extremely relevant that we not only conserve our herbal biodiversity but also cultivate it for its adequate utilization. Looking at the tremendous increase of population in the country, our compulsion would be not only to stabilize the agricultural production but to increase it further in eco-friendly and sustainable manner.

Today, neem has once again become an agro-scientific celebrity, as it has figured as the priority in seminars and several agricultural workshops all over the world. Modern western medicine is discovering the importance of neem which, the ancient Indians have known for thousands of years, that the neem tree has superb pharmaceutical and pesticidal qualities. Neem is a holy tree, the bark, leaves, and seeds are used to make medicines. Less frequently the root flower and fruits are also used.

Neem leaves are used for leprosy, eye disorders, bloody nose, intestinal worms, stomach upset, and loss of appetite, skin ulcers, diseases of the heart and blood vessels, fever, diabetes, gum disease (gingivitis), and liver problems. The leaves are also used for birth control and induce abortions. Almost all the districts of U. P. are covered under vrihad vriksharopan abhiyan, the mass plantation abhiyan of neem tree at every door will be worthy, shall be very crucial and beneficial. Definitely these approaches shall help to reduce the pollution level for the benefit of the rural mass.

References:

1. Arya, S. (2019). Evaluation of Bio efficacy of *Azadirachta indica* and *Mentha piperita* extract against *Papilio demoleus* L. on Citrus crop. *International Journal of Biological Innovations*. 1(2): 87-89.
2. Jafri, Z.H. and Mishra, S. (2022). Some Ethnoveterinary Medicinal Plants used among Tribals of Satpura range Burhanpur of M.P., India. *International Journal of Biological Innovations.* 4(1): 71-76.

3. Khanuja, S.P.S. (2007). Market potential of Medicinal and aromatic plants sector : The , Souvenir and abstracts Management of medicinal and aromatic plants in farming systems perspective, published by CSA University Kanpur, pp 74-86 .
4. Pandey, H. P. (2019). Socio-religious Plants of Terai Region of U.P., India. *International Journal of Biological Innovations*. 1(1): 18-22.
5. Prakash, S. and Verma, A.K. (2021). Relevance of ethno medicines of invertebrate origin used by Tribals at Indo-Nepal Border. *International Research Journal of Biological Sciences*. 10(1): 36-39.
6. Prasad, R. and Singh, A.K. (2007). Use of Herbs in health management of Livestock, Souvenir and abstracts Management of medicinal and aromatic plants in farming systems perspective, published by CSA University Kanpur, pp 196.
7. Singh, S.R. and Sharma, P. (2007). Market potential of Medicinal and aromatic plants in India, Souvenir and abstracts Management of medicinal and aromatic plants in farming systems perspective, published by CSA University Kanpur, pp 74-86.
8. Singh, V. and Vaish, S. (2017). Neem-as Medicine, Emerging trends in agriculture, environment and rural developmental challenges and solution: An Overview , Published by SBSRD Prayagraj, U.P.
9. Swaroop, D., Kishore, J. and Singh, A.K. (2022). Neem tree -must for every household of aspirational district, Souvenir and Abstracts, 14th Swadeshi Prem Jagriti Sangosthi - National Conference on Climate resilient and sustainable development of Horticulture ,Published by C.S.A. Kanpur oral pr. no10.2.9
10. Swaroop, D., Singh, R.K. and Alam, N. (2007). Medicinal plants, Herbs and Shrubs in the service of Livestock and their owners, Souvenir and abstracts Management of medicinal and aromatic plants in farming systems perspective, published by CSA University Kanpur, pp 195.
11. Vashishtha, P., Prakash, R., Rathi, P.K. and Singh, R.K. (2017). Safe grain storage practices among rural women in district Hardoi, Compendium and Abstracts-National Conference on Organic farming for sustainable agriculture and livelihood security under changing climatic conditions, Published by CSA Kanpur pp181.
12. Verma, A.K. (2019). Sustainable Development and Environmental Ethics. *International Journal on Environmental Sciences.* 10 (1): 1-5.
13. Vishwakarma, S.P. (2020). Organic farming: Three major dimensions of Life : Environment , Agriculture and Health , Published by SBSRD Prayagraj, U.P.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 53 - 58|

Study on bacterial infection of fresh water fishes inhabiting Arali-Kalegaon Dam, Osmanabad District

Shivaji G. Jetithor[1]* Datta Ashok Nalle[2]

[1]Department of Fishery Science

Yeshwantrao Chavan Mahavidyalaya, Tuljapur Dist. Osmanabad. (Maharashtra)

[2]Department of Zoology & Fishery Science

Rajarshi Shahu Mahavidyalaya (Autonomous) Latur (Maharashtra)

*Corresponding author: shivajijetithor@gmail.com

Abstract

The isolation study revealed the presence of Aeromonas hydrophila in skin, body fluid, heart, eye, kidney and liver of various species of fishes collected from Arali-Kalegaon Dam of Osmanabad district of Maharashtra. Presence of bacterium, Aeromonas hydrophila strongly suggests its ubiquitous nature. In the present study, the load of bacteria in lesion, considerable variation was noted in different months during the study period. Monthly variation of bacterial load in body lesion varied from 4.17×103 CFU/g to 3.11×106 CFU/g (Summer), in liver it varied from 7.17×103 CFU/g to 5.13×106 CFU/g, in kidney it varied from 4.98×104 CFU/g to 6.51×107 CFU/g. From the observation, monthly difference of bacterial load in three sampling sites was varied from 4.28×106 CFU/ml to 3.80 ×107 CFU/ml.

Keywords: Arali-Kalegaon dam, fish Disease, Bacterial infection, major carp.

Introduction:

Bacteria are one of an important causative agent of fish diseases in both wild and cultured fish and are responsible for serious economic losses. Few pathogens infect both freshwater and marine fish. In India Aeromonas hydrophila is a prime causative agent for pathogenicity in fishes and responsible for hemorrhagic septicemia, infections dropsy, rubller, red-mouth, red-pest and freshwater eel diseases. Aeromonas hydrophila is also suspected to be the principal causative agent of ulcerative disease noted in cultured fish in Indo Pacific region. The microorganism can be isolated from water within a wide range of physiochemical limits (pH 5.2 - 9.8; temperature < 10-45 °C). The aeromonads are Gram-negative, rod-shaped, facultative anaerobic, non-spore forming bacteria that are autochthonous and widely distributed in aquatic environments [1]. The genus is made up of psychrophiles and mesophiles from soil and aquatic environments and causes different kinds of diseases to many warm and cold-blooded animals.

Several reconsiderations on the taxonomy and nomenclature of Aeromonas genus have been carried out over the years [2-4]. The Aeromonas was initially positioned in the family Vibrionaceae but successive phylogenetic analyses point out that the genus Aeromonas is not closely related to Vibrios resulting in the relocation of Aeromonas from the family Vibrionaceae to a new family, the Aeromonadaceae [2,5]. The aeromonads and Enterobacteriaceae share many biochemical characteristics but are easily differentiated by oxidase test for which the aeromonads are positive. Generally, members of the genus are characteristically divided into three biochemically differentiated groups (Aeromonas hydrophila, Aeromonas caviae and Aeromonas sobria), and these contain a number of genomospecies, and recently, new species have been added [3, 6]. Currently, the genus comprises of 17 DNA hybridization groups (HGs) or genomospecies and 14 phenospecies [7]. There is comprehensive study essential in relation to the aquaculture management activities of present Arali - Kolegaon Dam, rivers and reservoirs are must be cared because it is assurance of our survival on earth. Messy management of water causes the water shortage. The available literature clearly shows that available fresh water from various water bodies is not equally available to all peoples and animals. The disease is worldwide affecting cultured cyprinids and other pond fish. It is commonly associated with fish populations suffering from stress. Fish are abnormally dark, show large subcutaneous haemorrhages and have distended abdomen. A. hydrophila caused a severe disease outbreak. Cultured fish suffer from Aeromonas sp. and Pseudomonas sp. infections with similar signs like dermal lesion, scale loss, frayed fins, tail and fin rot and Dropsy. Red skin disease is caused by Pseudomonas fluorescens in China. Red spot disease was caused by Aeromonas sp. Current decade is developing science, now days a number of pathogens have turn into significant and harmful to animal health. Recent data and research show the spreading of pathogens in animal group. Utilization of molecular techniques for detecting and typing of pathogens, as well as to identify the beneficial micro organisms which further attack upon pathogens [8].

METHODOLOGY

1. Microbial study:

Petri dishes, test tube, glass pipettes, conical flask, tips, cotton physiological saline, Agar media were sterilized in an autoclave at 121°C for 20 minutes. Nutrient Agar media was made by 8.4 g agar and distilled water up to 300 ml and TSA media was made by 19 g agar and distilled water up to 500 ml.

Study area: Arali - kalegaon dam

Present investigation will be carried out at Arali –Kalegaon dam (latitude 17.51° N, longitude 76.07° E) which situated at Kalegaon village in Tuljapur Block of Osmanabad District. The total catchment

area of this dam is about 57.95 ha with total Capacity to hold water is 6.040 lac cubic meter. The maximum length of dam is 1265 meter, having one door with a maximum height of dam is 14.65 meter. The water spread area is noted as 1.900 sq/m. The water from this dam is been utilized by Arali, Kalegaon, Yewati, and Nanduri and it also have the huge amount of the fishes prawn and many watery organisms.

Collection:

Infected fishes were collected from different waterbodies like rivers, sampling ponds and dams of Osmanabad district during the investigation period of 6 month. Bacterial isolates were collected from ulcer type lesion on body surface such as caudal, dorsal, ventral, lateral, head lesion and fin rot of major carp fish species viz. *C. catla*, *L. rohita*, *C. mrigala*, and *Cyprinus carpio***.**

Bacteriological investigation:

Tryptic Soy Agar (TSA) was used for culture of *Aeromonas* sp. Nutrient Agar was used for culture of *Pseudomonas* sp. and finally, the identification by using enterobacteriaceae kit, cytochrome oxidase test and biochemical characteristics.

Bacterial infection in diseased *C. carpio*

Sampling:

Three specimens of *C. carpio* were collected monthly from the sampling pond. Sampling was carried out by following the method [9]. Samples were collected from body lesion, liver and kidney of fish.

Body lesion:

Liver samples were collected monthly for investigation. Fishes were killed by a light hurt on the neck region and then the lesion was collected by sterile scalpel and kept in a pre-weighed sterile weighing boat. After weighed (0.1g) the lesion was homogenized for the preparation of suspension in sterile 1ml physiological saline (0.85% NaCl).

Liver:

The body exterior of fish samples was disinfected with 70% ethyl alcohol. The abdomen of diseased fish was opened by aseptic dissection and then the liver was taken out carefully with the help of sterilized forceps.

Kidney:

The kidney samples were prepared by following the same procedure as done for the preparation of liver. Nutrient Agar was used for culture.

Bacterial load in dam water:

Water samples were collected from 3 sampling sites of dam once a month during the study period. Water samples were collected in sterilized reagent bottles from the depth of 25-35 cm below the surface at the time from 10:00 am to 12:00 pm. These samples were 1ml diluted in sterile 9 ml physiological saline through 10 fold dilution for inoculation on the culture media (Nutrient Agar).

Results and Discussion

Identification of bacteria

The investigations demonstrated that freshwater fishes were affected by infection with different types of bacteria. During the investigated period dermal lesion, ulcer, EUS, tail and fin rot, scale loss type of bacterial diseases was very common. Bacterial investigation was collected from ulcer type of lesion and tail and fin rot type of diseases. The recovered bacterial genera were identified as *Aeromonas* sp. and *Pseudomonas* sp. (Table-1). *Aeromonas* sp. are gram negative, acid fast, non sporing rod with a single polar flagellum, measuring about 0.3 - 1.0 µmin diameter and 1.0 - 3.5 µm in length. Bacteria of the *Pseudomonas* sp. are gram negative, non-acid fast, non-sporing rod with a single polar flagellum, Circular, smooth raised colonies were produce on both Agar (TSA and nutrient agar).

Table 1: Isolation of bacteria from various sample sites at Arali-Kalegaon dam

Species	**Site of isolation**	***Aeromonas* sp**	***Pseudomonas* sp.**
C. catla	Skin, Fin	+	-
L. rohita	Skin, Fin	+	-
C. mrigala	Fin	+	-
C. carpio	Fin	+	+

(+) = **present,** (-) = **not present**

Colonies of *Aeromonas* sp. were yellowish and *Pseudomonas* sp. creamy whitish. Glucose fermentation is a critical reaction that differentiates the *Aeromonas* sp. from *Pseudomonas* sp. Bacteria were inoculated into two tubes of oxidation fermentation (OF) basal medium supplemented with 1% glucose. Results were interpreted as follows: yellow coloration in both tubes indicates acidic fermentation of glucose typical of *Aeromonas* sp.

Table 2: Identification of *Aeronomas hydrophila* using biochemical test. (Manuallt and Enterobacteriaceae Kit)

Biochemical Test	**AHS**	**AH1**	**AH2**	**AH3**
Morphology				
Capsule formation	+	+	+	+
Mortality	+	+	+	+
Flagella	+	+	+	+
Physiology				
Catalase production	+	+	+	+
Growth in KCN	+	+	+	+
Carbohydrate Metabolism				
Production of Acid in Glucose	+	+	+	+
L – arabinose	+	+	+	+
D – xylose	-	-	-	-
L – rhamnose	-	-	-	-
D – lactose	-	-	-	-
D – mannose	+	+	+	+
Sorbose	+	+	+	+
D – maltose	+	+	+	+
D – sucrose	+	+	+	+
D – mannitol	+	+	+	+
D – dulcitol	-	-	-	-
D – sorbitol	-	-	-	-
Salicine	-	-	-	-
Esculine hydrolysis	-	-	+	-
Malonate	+	+	+	+
O / 129 vibriostat				
Citrate utilization	+	+	+	+
Nitrate	+	+	+	+

reduction				
Adonitol	-	-	-	-
Inositol	-	-	-	-
Gram Strain	-	-	-	-
Cytochrome Oxidase	+	+	+	+

The isolation study revealed presence of *Aeromonas hydrophila* in skin, body fluid, heart, eye, kidney and liver of various species of fish collected from the study area. The high percentage incidence of *Aeronomas hydrophila* in diseased fishes collected from Arali-Kalegaon Dam of Osmanabad district of Maharashtra. Presence of bacterium, *Aeromonas hydrophila* strongly suggest its the ubiquitous nature, similar observations were recorded by [9, 10] isolated the same bacteria from lesions of ulcers and other visceral organs of different species of fish examined in the Orissa state and Bandyopadhyay *et al*. (2003) from an ornamental fish (*Caraccium auratus*). The bacterium is frequently associated with infections as secondary invader as reported and has been branded as a facultative pathogen. It is thought that this organism invades only when the host resistance is lowered by environmental stress factors such as high organic load, over crow dung and sublethal oxygen levels in water. There is a positive correlation between water temperature and probability of mortality in steelhead trout inoculated with low numbers of *Aeromonas hydrophila*. They concluded that higher temperature favored rapid proliferation of the bacteria and subsequent host mortality. In the present study the isolation of *Aeromonas hydraphila* was aptly done from the ulcerated skin lesions, kidney, liver, body fluid, eye, heart of Gold fish, Angel fish,. However, no correlations could be made with the environmental temperature as the disease occurred throughout the year with varying atmospheric temperature [11.12].

The balance of ingredients in this medium provided a nutrient base and chemophysical stability. However, it was also pointed out that all the yellow colonies having black centers should be subsequently tested for oxidase activities to eliminate the possibilities of citrobacter sp. and / or other organisms. Similar methods were followed in the present study, which proved to be useful. Until now the role of *Aeromonas hydrophila* in various fish diseases was not very clear. The present study has elucidated the role of this organism in dropsy, fin and tail rot and more elaborately in Epizootic Ulcerative Syndrome (EUS).

References

1. H. Daskalov, “The importance of *Aeromonas hydrophila* in food safety,” Food Control, vol. 17, no. 6, pp. 474-483, 2006. View at Publisher ·
2. R.R. Colwell, M.T. Mac Donell, and J. DeLey, “Proposal to recognize the family Aeromonadaceae fam. nov,” International Journal of Systematic Bacteriology, vol. 36, no. 3, pp. 473-477, 1986.
3. S. L. Abbott, L. S. Seli, M. Catino Jr., M. A. Hartley, and J. M. Janda, “Misidentification of unusual *Aeromonas species* as members of

the genus vibrio: a continuing problem," Journal of Clinical Microbiology, vol. 36, no. 4, pp. 1103-1104, 1998.

4. S.L. Abbott, W.K.W. Cheung, and J.M. Janda, "The genus Aeromonas: biochemical characteristics, atypical reactions, and phenotypic identification schemes," Journal of Clinical Microbiology, vol. 41, no. 6, pp. 2348-2357, 2003. View at Google Scholar · View at Scopus
5. P. Villari, M. Crispino, P. Montuori, and S. Boccia, "Molecular typing of Aeromonas isolates in natural mineral waters," Applied and Environmental Microbiology, vol. 69, no. 1, pp. 697-701, 2003.
6. J.M. Janda and S.L. Abbott, "The genus Aeromonas: taxonomy, pathogenicity, and infection," Clinical Microbiology Reviews, vol. 23, no. 1, pp. 35-73, 2010. View at Publisher · View at Google Scholar.
7. A.M. Carnahan and S.W. Joseph, "Aeromonadaceae," in The Proteobacteria, Part B, Bergey's Manual of Systematic Bacteriology, D. J. Brenner, J. T. Krieg, and G. M. Garrity, Eds., Springer, New York, NY, USA, 2005.
8. Datta A. Nalle, Divya D.Nagapure, Madhuri Y. Bhande (2021) Molecular techniques for identification of microorganisms obtained from different sources review based research upon lactic acid bacteria." International Research Journal of Modernization in Engineering Technology & Science (IRJMETS) Volume 3 Issue
9. Sarker, M.G.A., A. Sarker and M.B.R. Chowdhury, 1999. Occurrence of aeromonad pathogens in carp fingerling at Mymensingh region of Bangladesh. *Bangladesh J. Fish*., 22: 7-12.
10. Banu, A.N.H., M.A. Islam and M.B.R. Chowdhury, 2001. Bacterial load in pond water and different organs of an Indian major carp *Cirrhinus mrigala* Ham. *Bangladesh J. Fish. Res.*, 5(1**)**: 53-58.
11. Barrow, G.I. and R.K.M. Feltham, 1993. *Cowan and Stell's Manual for the Identification of Medical Bacteria*.3rd edn. Cambridge University Press. 311pp.
12. Charganowski, T.H., 1985. Seasonal abundance and biomass of bacteria in a South Western reservoir. USA.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 59 - 70|

Sugarcane Bagasse: An Agricultural Waste for Environmental Applications

Avnish Kumar Tripathi and Jitendra Kumar*
Department of Chemistry, MLK PG College, Balrampur (U.P.)
*Corresponding author: jitendra.iit@gmail.com

Introduction

Environmental deterioration is a major concern particularly for developing nations because of the uncontrolled release of numerous harmful species that are produced by industrialization, urbanization and day to day human activities[1, 2].Severe degradation of quality of air and water has been observed probably as a result of the industrial revolution in the twenty-first century in South Asian nations like Bangladesh and India. More than 180 rivers in India receive a significant volume of untreated industrial waste and effluents, mostly from the dye, fertilizer, food processing, metal processing, pesticides, pharmaceutical, pulp and paper, textile, and tannery products industries[1] which render the water undrinkable. Different contaminants, including heavy metals, dyes, and other organic pollutants like pharmaceutics, herbicides, insecticides etc are found to be present in water bodies. Upon introduction into the environment, these toxic chemicals have the potential to severely affect the normal physiological function of land and aquatic animals and do great ecological damage.[3] Therefore, it is imperative to develop sustainable water remediation technologies to remove these pollutants so that the drinkable water is made available to the large population and also to restore the affected ecosystems.

A variety of water treatment technologies have been developed over the years to remove contaminants from wastewater, including adsorption, flocculation, coagulation, biological oxidation, sedimentation, and photo-Fenton treatment. Advanced oxidation processes also include chemical oxidation, chemical degradation, wet oxidation, incineration, and reverse osmosis.[4, 5] Although efficient, many of these techniques involves tedious operational procedure and are very costly, thus limiting worldwide applicability. In this context, adsorption techniques have recently attracted much attention as a means of maintaining the ecosphere health. This method is quite suitable for its efficiency and simple operational procedure; and a variety of readily available adsorbents have been successfully employed as adsorbent. It has been shown that this method of remediation is useful an appealing for removing variety of inorganic and organic pollutants especially non-biodegradable contaminants (such as colors) from

wastewater.[6-8] In the last 20 years, considerable initiatives have been taken to provide a comprehensive overview of the procedures and adsorbent materials now in use for the dye removal and decolorization of aqueous waste through review articles, research papers, and reports.

Because of its large adsorption capacity, activated carbon is used as an excellent adsorbent in the majority of commercial systems to remove pollutants from water. Activated carbon is a favored adsorbent, but its cost prevents it from being used widely. Finding inexpensive substitute adsorbents has been tried in an attempt to decrease cost of water treatment. Various investigations have already been carried out to create less expensive and efficient adsorbent from a variety of starting materials. As a result, a range of agrowastes have been explored to develop low-cost adsorbent. Due to its worldwide applicability, simplicity, flexibility, propensity for organic pollutants, high efficacy and efficiency, adsorption by agro-industrial residues has been shown to be one of the best techniques now available for the elimination of organic pollutants Additionally, without producing any harmful by-products, this procedure may get rid of organic contaminants from water.[9]Many agricultural wastes based biosorbents such as plant leaves, husks, fruit and vegetable peels etc. have been explored targeting a range of metal ions, dyes and other organics and revealed effect of various process parameters specific to the adsorbate species such as adsorbent dosage, pollutant concentration, pH of the medium, retention time, shaking speed and functionalization and activation of adsorbent over the adsorption process and efficiency. By choosing the right adsorbent for the removal of pollutants, it is possible to make the adsorption process promising and financially viable.[10, 11]

Countless sectors generate tremendous quantities of garbage, which poses disposal challenges and contributes to environmental contamination in numerous ways (air, soil and water). One of these is the sugar business, which produces a lot of trash.[12, 13] Brazil, India, China, Thailand, and Pakistan are the top five producers out of more than 123 countries that manufacture sugar each year, which amounts to over 160 million tons. A sizeable amount of wastes, including high amounts of suspended particles, organic matter, effluent, sludge, press mud, and bagasse, are generated during the manufacturing of sugar.[14]

According to the data from Indian Sugar Mills Association (ISMA), around 520 mills are operating in India in 2022-23 which produced 193.5 lakh tons of sugar out of which Uttar Pradesh has about 120 operational sugar mills which produce approximately 51 lakh tons of sugar annually. More than 70% of the people of Uttar Pradesh benefit from the sugar industry, one of the state's major agricultural industries, mainly through cane cultivation which is used by these industries for extracting sugar cane juice which is then processed to make sugar.[15] Because of the extensive farming territory dedicated to the cultivation of sugarcane and abundance of sugar mills, Uttar Pradesh is referred to as the "Sugar Bowl of India."

Two major categories of solid waste produced by the sugarcane industry are bagasse and filter cake. Bagasse is the terminology used for the solid byproduct that left after the juice has been extracted from the sugarcane. According to studies, bagasse makes up around 33% of the total amount of crushed cane. Its energy content per kilogram is around 1920, and it is mostly utilized as fuel in boilers to convert water into steam. A sugar mill generates almost 3 tons of moist bagasse for every 10 tons of crushed sugarcane [16]. When bagasse is burned to produce energy and steam for power, bagasse fly ash is formed. Filter cake or press mud cake is the description for the precipitate that remains in the form of a sludge slurry following filtration.

(a) (b)

Figure 1: Sugarcane fields (a) and sugarcane bagasse (b) after extraction of juice

In this chapter, we aim to present sugarcane bagasse (SCB) as a low-cost adsorbent in its native as well as modified form to mitigate pollutants from aqueous media, which will provide a guidance to a diverse range of researchers working in this field.[17,18.]

Modification of Sugarcane Bagasse:

Modifications of SCB could dramatically improve its adsorption capacities. Various modification methods have been explored for targeting contaminants which can be classified as physical or mechanical procedures or chemical modification. Chemical modification strategy is much sought after method as it enhances the removal efficiency of SCB by enriching the surface of adsorbent with suitable functionalities necessary for the removal of inorganic and organic pollutants. Activation of SCB with various chemicals (such as acids, bases, or surfactants), grafting, and impregnation of magnetic nanoparticles for easy separation of adsorbent after removal process are also chemical based methods adopted for SCB.

Chemical Modification:

SCB can be modified using a range of chemicals for enhanced removal capacity and has been accomplished through pretreatment or washing, grafting, polymerization, and mercerization. These modification tailor

the surface of sugarcane bagasse in a multitude manner including increased binding sites, the elimination of inhibitory groups, improved ion-exchange capabilities, and the creation of novel functional groups which offer beneficial interactions against pollutants.[19]For example, sugarcane bagasse in powdered form was suspended in a 1% NaOH solution for 30 min, then treated with 1% acrylic acid for 1 h at room temperature. This treatment resulted in a larger surface area available for the adsorption of pollutant ions.[20]

For the removal of cationic dyes, using a chemical grafting technique, the modified SCB was prepared. A round-bottomed flask filled with 30 mL of N,N-dimethylacetamide received 1.0 g of Pyromellitic dianhydride (PMDA) and 0.5 g of SCB. The modified SCB was generated after 4 hours of stirring at 50 °C, and it was then washed with water and NaOH (0.1 mol/L) in sequence. It was then dried and put in a desiccator for further use.[21]For the removal azo dyes,1% formaldehyde was applied to SCB in a 1:5 ratio of bagasse/formaldehyde (w/v) at 50°C for 4 h. In order to remove any free formaldehyde, the sugarcane bagasse was filtered out before being activated for 24 hours at 80°C in a hot air oven.[22] To remove synthetic dyes 0.5 g SCB was treated with varying amounts of Meldrum's acid using different concentration (0.5, 1.0, 1.5, 2.0, and 3.0 g) for different time durations (1, 2, 4, 6, 12, and 24 h).[23]Similarly, a Tartaric acid modified SCB was synthesized where 12 mL of 0.5 M TA was added to 1 g of dried bagasse following which the mixture was dried at 50 ℃ in an oven. After 24 hours, the temperature of the oven was increased to 120 ℃ and kept for 90 minutes to complete the thermochemical reaction between the acid and bagasse. The oven was cooled and material was washed with distilled water until the turbid residual solution became clear. Further treatment with 0.1 M NaOH with varying ratio was done by stirring for 60 minutes. Finally, the bagasse was washed with distilled water at room temperature to remove any remaining alkali and bring the residual solution to a pH of 7. In order to attain constant weight, the wet tartaric acid modified bagasse was dried at 50 ℃. To attain the appropriate particle size (125-250 m), the dry adsorbent was grinded and sieved and then stored in desiccators.[24]

Magnetically modified SCB: Magnetically modified absorbents are advantageous due to easy separation of adsorbent from aqueous medium. They also have the propensity to exhibit large adsorption capacities with quick adsorption rates probably due to favorable interaction with the magnetic nanomaterials. The magnetic modification of sugarcane bagasse has been investigated be several groups for the removal of dyes. To concurrently remove cationic and anionic dye, magnetic carboxyl group-modified and non-magnetic amine group-modified sugarcane bagasse biosorbents were synthesized and mixed.[25] These

adjustments improved dye adsorption capacity as compared to native sugarcane bagasse, with the magnetic carboxyl group-modified bagasse having the highest capacity for Basic Magenta (BM)dye and the non-magnetic amine group-modified bagasse showed better results for Congo Red dye. When sugarcane bagasse isn't treated, adsorption frequently occurs by hydrogen bonding between the bagasse's hydroxy groups and the dye molecule's electronegative groups; but, after the aforementioned alterations, the addition of the carboxyl and amine groups lead to a more effective adsorption.[25]

Immobilization of sugarcane bagasse:

The use of dead biomass rather than living tissues makes biomass immobilisation an appropriate method for manipulating biosorbent surfaces. Contrary to what was expected, it was discovered that Na-alginate-immobilized sugarcane bagasse had a lesser capability for removing Direct Violet 51 dye from an aqueous solution (21.9 mg/g) than native (36.17 mg/g) and HCl-treated (39.6 mg/g) bagasse.[26] The inhibition of binding sites during immobilisation may have resulted in less dye removal from immobilised sugarcane bagasse than from native and chemically modified sugarcane bagasse. Nevertheless, immobilised activated biomass technologies might be a useful complement to the wastewater treatment process.[27]

Characterization of SCB:

The well-known Brunauer-Emmet-Teller (BET) method is employed to calculate the specific surface area of the bagasse-based adsorbents. The chemical functionality can be determined using Fourier-transforminfrared (FTIR) spectra. The incorporation of nanomaterials can be estimated through X-ray photoelectron spectroscopy (XPS) analysis and Thermogravimetric analysis (TGA) analysis. Carbon, Hydrogen and nitrogen (CHN) analysis also furnishes information regarding the enrichment of certain functional groups based on relative elemental percentage. Scanning electron microscopy(SEM) is used to investigate the surface texture of bagasse.

Removal of dyes using SCB based adsorbents:

Dyeing, paper and pulp, tannery, textile, and paint industries all contribute significantly to an important class of pollutants known as dyes. The major purpose of dyes is to alter the color of various substrates, including paper, fabric, leather, and others. The main impact of dyes on photosynthetic activity of aquatic plants has already been established.[28] In addition, a lot of dyes are poisonous or even cancer-causing, which has an adverse impact on both human and aquatic life.

Raw SCB:

The removal of erythrosine B (EB) and methylene blue (MB) from the SCB was assessed using batch mode after at least four to five washings with tap water, a 48-hour soak in distilled water, a 24-hour period of drying at 100 C, and the aforementioned processes. For MB and EB, the optimum adsorption pH was 9 and the range between 7 and 9. The maximum elimination was attained at an

equilibration time of 1 h for contact time (10–180 min examined range).[29] Different effects on the uptake of dyes were observed when the temperature was raised from 35 to 55 C; EB removal increased while MB adsorption rose till 45 C before declining. It was discovered that SCB had a maximal dye absorption capacity of 108.67 mg/g.

For MB and Safranin (SA), the adsorption capacity increased from 34% to 88% and from 26% to 89%, respectively, with an increase in adsorbent dosage from 0.05 to 0.5 g. Due to the repulsive forces between the positively charged adsorbent surface and positively charged dyes at low pH values, the highest adsorption for both dyes occurred at pH 10, where it happened. After 210 minutes, adsorption equilibrium was attained. Desorption experiments were performed with various doses of HCl (0.1, 0.5, and 1 N), and the best desorption amount was found with 0.1 N HCl (desorption amount SA=74.98 mg/gdesorption amount MB=29.39 mg/g).[30]

Congo red (CR) adsorption by ball-milled SCB was investigated. The pHpzc (point of zero charge) was calculated to be 5, and increasing the pH from 5 to 10 had a negative impact on the amount of adsorbed material (93.4% at pH 5 vs. 84.7% at pH 10). The increase in adsorbent dosage from 1 g L-1 to 20 g L-1 resulted in an increase in the CR removal from 11.3% to 98.3%. The interaction between the carboxyl and hydroxyl groups of the adsorbent and the CR functional groups was visible in FTIR spectra taken before and after adsorption. A decrease in randomness at the solid/solution interface was predicted by thermodynamic analysis to accompany the spontaneity and exothermicity of the process.[31]

Researchers investigated the usage of SCB to remove malachite green (MG) colour.[32] It was discovered that the uptake of dye is regulated by external mass transfer in the early stages and intraparticle diffusion in the later stages. The exothermic adsorption process was spontaneous, and the unpredictability at the solid/solute boundary decreased. According to the Boyd model, the external mass transfer was the stage of the sorption process that moved at the slowest speed.

Sugar beet pulp was evaluated for the adsorptive removal of basic violet 16 (BV16) dye.[33] A maximum removal of 85.2% was observed using an adsorbent dose of 10 g L-1. We identified three potential adsorption mechanisms: surface adsorption, bulk diffusion, and intra-particle diffusion. It was determined that the removal process was exothermic, physical, and not spontaneous.

Chemically modified SCB:

SCB that had been treated with methacrylic acid was created and tested for MG adsorption.[34] The amount of MG adsorbed was at its lowest at pH 2, and as pH increased from 2 to 6, MG adsorption increased. However, there was no discernible change in the amount adsorbed after that.

To create carbonaceous bagasse (C-SCB), which was used to remove MG, SCB was treated with

formaldehyde and sulfuric acid.[35] The Langmuir isotherm had the best fit when compared to the examined isotherms (Friendlich, Dubinin-Radushkevich, and others). The C-SCB showed about 89% dye clearance as compared to raw SCB, probably because of its larger surface area.

The ability of SCB and SCB modified with cetylpyridinium bromide (CPBr) to absorb the acid orange 7 (AO7) dye from an aqueous solution was investigated.[36] Three different CPBr concentrations0.1, 1.0, and 4.0 mMwere added to the pretreatment SCB to modify it, resulting in the adsorbents SCBC1, SCBC2, and SCBC3. Following the order SCBC3 > SCBC2 > SCBC1 > SCB, the greatest adsorption capacity was found. According to research, the pH regulates the removal process, with the highest removal rates for unmodified and modified adsorbents occurring at pH 2 and 7, respectively.

Propionic acid was used to treat raw SCB, and the presence of MB and orange II was then checked (OR2)[37].For MB and OR2, the optimal adsorption conditions were pH 3–11 and 2, respectively. It was discovered that the removal percentage increased with the increase in adsorbent dose from 0.2 g/50 mL to 2 g/50 mL. Particle size (0.25 to 1 mm particle size range) has a negative impact on OR2's absorption. MB adsorbed more quickly than OR2 and both colours reached equilibrium after 60 minutes.

Basic blue 3 (BB3) and reactive orange 16 (RO16) were sequestered using quartenized sugarcane bagasse (QSCB) in single and double dye solutions[38]. It was discovered that at basic pH values (optimum at pH=10) and acid pH values (optimum at pH=2), respectively, the adsorption of BB3 and RO16 increased. The best fits to the experimental data, according to kinetic and isotherm analyses, were the Freundlich isotherm model and the pseudo-second-order kinetic model. In contrast to the exothermic adsorption of RO16, the absorption of BBE was improved by increasing the temperature from 26 to 80 oC, demonstrating the endothermic character of the process.

Additionally, the removal of MB by raw and processed SCB using CaCl2 and NaOH was investigated.[39]In case of raw SCB, at higher tested concentration, adsorption was reached plateau in 15 min, while at lowest tested concentration of 0.833 g L^{-1}, 30 min was needed to equilibrate. At the intermediate pH, approximately $4 < pH < 8$, the NaOH-SCB gave the highest uptake efficiency. One possible explanation was explained that a delignification might be occurred, resulted in an increment of adsorptive properties of NaOH-SCB. At alkaline pH, all the adsorbents showed similar removal capacities.

Modified SCBs were created and utilised to adsorb methyl red, including formaldehyde-SCB (abbreviated as F-SCB) and sulphuric acid-SCB (abbreviated as S-SCB).[40] A commercial activated carbon (PAC) was also tested for the same purpose for comparison's sake. While utilising activated carbon, the adsorption remained constant over the entire pH

range, it was discovered that modified SCBs performed better when the pH was between 7 and 10. Adsorption efficiency was in the following order: PAC>S-SCB>F-SCB.

Quaternary ammonium salt pre-treatment of SBP to examine its Removal of reactive red 2 by adsorptive ability (RR2).[41] The efficacy of the change was indicated by the modified SCB's improved removal efficiency in the examined pH range (2–10) compared to raw SBP. The equilibrium was reached in less than 60 minutes, and the Weber-Morris model demonstrated that, while intra-particle diffusion played a role in the adsorption mechanism, it was not the only rate-limiting step. According to estimates, chemisorption occurred when the mean energy of biosorption ranged between 28.01 and 22.74 kJ mol-1. The endothermicity and spontaneity of the removal process were demonstrated by the calculation of thermodynamic parameters. They then looked at the quaternary ammonium SBP's capacity to bind acid red 1 (AR1).[42]The equilibrium was reached within 30 minutes at the ideal pH 2. The increase in adsorption capacity from 84.68 to 100.46 mg/g, respectively, was caused by increasing the temperature from 10 to 50 ˚C.

The experiment was performed with a set adsorbent dosage (0.4 g), at room temperature, pH9.0, and varying beginning MB dye concentrations (100-300 mg/L) over various time periods (1-35 min). The amount of dye actually adsorbed per unit mass of adsorbent rose with dye concentration, despite the fact that the percentage of colour removal decreased with starting dye concentration. The initial dye concentration offers the vital impetus needed to overcome obstacles in the mass transfer of MB between the aqueous and solid phases. The interaction between the adsorbates and adsorbents is improved by the increased starting dye concentration. Accordingly, adsorption absorption is higher at 300 mg/L of starting dye concentration. than it is at 100 mg/L.[24]

For MG and gentian violet(GV), from 2 to 10, the impact of pH on MB and GV adsorption was investigated. By adding a few drops of solutions containing 0.01e1.0 mol/L of NaOH and/or HCl, the pH was changed. In this experiment, 20 mg of SCB 2 was added to 100.0 mL of dye solution with known concentrations (MB: 200 mg/L, GV: 450 mg/L) at various pH levels. For MB and GV, respectively, the stirring period was 6 hours and 20 hours. The samples were added to 250 mL Erlenmeyer flasks that contained 100.0 mL of dye solution at established concentrations (150 mg/L for MB and 400 mg/L for GV), all while being constantly stirred. For the duration required to reach equilibrium, each experiment was run at the pH where dye adsorption was the highest, which was 8.0 for both dyes.[43]

In order to evaluate the elimination of Auramine-O(AO) and safranin-T(ST) at pH values of 4.5 and 7.0 from mono-component spiking aqueous solutions, SCB was chemically treated using 1,2,4-benzenetricarboxylic anhydride (TA). The reason TA was

chosen is that it has carboxylic groups that can be used to adsorb AO and ST by electrostatic contact, hydrogen bonding, and dipole-dipole interactions. In addition, it contains an aromatic ring that can interact with both dyes through p-p stacking, increasing the adsorption capacity of the modified SB. Using 20.0 mg of tri-malliated sugarcane bagasse (STA), aqueous dye solutions buffered at pH 7.0, 130 rpm of agitation, and equilibration periods of 1620 and 2160 min for AO and ST, respectively, the STA samples loaded with a dye were produced using the same adsorption process as previously described. The pH of the solution affects the surface charges of both the dyes and the STA adsorbent. AO always had a charge of +1 over the pH range examined, whereas ST had a charge of +1 or +2, depending on the pH of the solution.[44]

As possible adsorbents of various organic pollutants from aqueous solution, sugarcane bagasse in both its raw and modified forms have been thoroughly investigated.[45] When it comes to the adsorption of organic pollutants by sugarcane bagasse and its derivatives, a number of variables, including biosorbent dosage, initial pollutant concentration, solution pH and temperature, and contact time, play a significant role. Additionally, the type of the adsorbentwhich was impacted by several modification processeswas a factor in phenol adsorption. With a maximum adsorption capacity of 6.65 g g1, modified sugarcane bagasse was able to remove hydrocarbons, and researchers noted that it was particularly effective at treating oily aqueous effluent.

Perspectives for the future:

The present literature review the effectiveness of sugar industry waste materials as adsorbents in removing various aquatic pollutants, as well as new developments in this field. The results of the investigation showed that chemical surface modification significantly improved the removal effectiveness of sugarcane bagasse-based adsorbents with favourable and adsorption efficiency. The nature of the contaminants and the circumstances of the experiments have a significant impact on the adsorbents' performance. The majority of studies used batch mode experiments with one synthetic pollutant solution in an effort to estimate the maximal adsorption capabilities. The concentration of the starting pollutant, the length of contact, the pH of the solution, the amount of adsorbent used, the temperature, and other factors were found to have a substantial impact on the adsorption process. The experiments were found to fit well with the Langmuir isotherm and pseudo-second kinetic model. Three parameter isotherm models and diffusion kinetic models are strongly advised in addition to the well-known and most frequently used isotherms and kinetic models for a thorough understanding of the mechanism of adsorption.

This in-depth analysis also showed that a range of modifications can be made to sugarcane bagasse adsorbents to increase their capacity for adsorption, though chemical procedures have been

shown to be typically preferable in terms of boosting the stability and adsorption capacity of the biosorbents. The chemical make-up of adsorbents as well as other physicochemical experimental parameters, such as the pH of the solution, the pollutant's initial concentration, the dosage of the adsorbent, and the system's contact period, all affect their ability to adsorb substances. Sugarcane bagasse has the potential to be developed into new absorbent materials that may be used to remove a wide variety of pollutants because of its maximal adsorption capacity, simplicity of use, and universal nature.

Although great progress has been made in understanding the mechanics of adsorption on sugarcane bagasse based adsorbents, the following objectives are suggested for future study on solid-liquid adsorption: (1) demonstrate the use of sugarcane bagasse adsorbents at the pilot and industrial scales; (2) demonstrate the effectiveness of adsorption techniques under extensive operating conditions, using real effluents rather than simulated wastewater; (3) increase the adsorption rate, decrease the reaction time, and develop composite nano-material adsorbents; and (4) conduct a molecular modelling study to elucidate the sugarcane bagasse-associated adsorption mechanism(s).

References:

1. A. A. Abdelhafez and J. Li, *Soil and Sediment Contamination: An International Journal*, 2014, 23, 850-868.
2. H. Tahir, M. Sultan, N. Akhtar, U. Hameed and T. Abid, *Journal of Saudi Chemical Society*, 2016, 20, S115-S121.
3. S. Chakravarty, A. Mohanty, T. N. Sudha, A. K. Upadhyay, J. Konar, J. K. Sircar, A. Madhukar and K. K. Gupta, *Journal of hazardous materials*, 2010, 173, 502-509.
4. C. Duran, D. Ozdes, A. Gundogdu and H. B. Senturk, *Journal of Chemical & Engineering Data*, 2011, 56, 2136-2147.
5. J. M. Salman, V. O. Njoku and B. H. Hameed, *Chemical engineering journal*, 2011, 174, 41-48.
6. L. G. Da Silva, R. Ruggiero, P. d. M. Gontijo, R. B. Pinto, B. Royer, E. C. Lima, T. H. M. Fernandes and T. Calvete, *Chemical Engineering Journal*, 2011, 168, 620-628.
7. I. Ali and V. K. Gupta, *Nature protocols*, 2006, 1, 2661-2667.
8. S. A. Saad, K. M. Isa and R. Bahari, *Desalination*, 2010, 264, 123-128.
9. I. Ali, M. Asim and T. A. Khan, *Journal of environmental management*, 2012, 113, 170-183.
10. G. Annadurai, R.-S. Juang and D.-J. Lee, *Journal of hazardous materials*, 2002, 92, 263-274.
11. R. Sivaraj, C. Namasivayam and K. Kadirvelu, *Waste management*, 2001, 21, 105-110.
12. M. Balakrishnan and V. S. Batra, *Journal of Environmental Management*, 2011, 92, 2886-2891.
13. A. Bhatnagar, K. K. Kesari and N. Shurpali, *Water, Air, & Soil Pollution*, 2016, 227, 1-30.
14. P. Muthusamy, S. Murugan and M. Smitha, *International Research Journal of Biological Sciences*, 2012, 1, 7-11.

15. F. Rahman and N. Bee, *Economic Affairs*, 2019, 64, 537-545.
16. I. Anastopoulos, A. Bhatnagar, B. H. Hameed, Y. S. Ok and M. Omirou, *Journal of Molecular Liquids*, 2017, 240, 179-188.
17. H. H. Ngo, W. Guo, J. Zhang, S. Liang, C. Ton-That and X. Zhang, *Bioresource technology*, 2015, 182, 353-363.
18. Y. Zhou, L. Zhang and Z. Cheng, *Journal of Molecular Liquids*, 2015, 212, 739-762.
19. S. Kamel, H. Abou-Yousef, M. Yousef and M. El-Sakhawy, *Carbohydrate Polymers*, 2012, 88, 250-256.
20. V. Mittal and S. Sinha, *Science and Engineering of Composite Materials*, 2017, 24, 237-243.
21. J.-X. Yu, R.-A. Chi, J. Guo, Y.-F. Zhang, Z.-G. Xu and C.-Q. Xiao, *Applied surface science*, 2012, 258, 4085-4090.
22. A. L. Abdullah, M. M. Salleh, M. S. Mazlina, M. Noor, M. Osman, R. Wagiran and S. Sobri, *International Journal of engineering and technology*, 2005, 2, 8-13.
23. T. C. Sarker, S. M. G. G. Azam, A. M. A. El-Gawad, S. A. Gaglione and G. Bonanomi, *Clean Technologies and Environmental Policy*, 2017, 19, 2343-2362.
24. L. W. Low, T. T. Teng, N. Morad and B. Azahari, *Apcbee Procedia*, 2012, 1, 103-109.
25. J.-x. Yu, J. Zhu, L.-y. Feng and R.-a. Chi, *Journal of Colloid and Interface Science*, 2015, 451, 153-160.
26. S. Sadaf, H. N. Bhatti, S. Nausheen and S. Noreen, *Archives of environmental contamination and toxicology*, 2014, 66, 557-571.
27. S. Zaheer, H. Bhatti, S. Sadaf, Y. Safa and M. Zia-ur-Rehman, *JAPS: Journal of Animal & Plant Sciences*, 2014, 24, 272-279.
28. A. M. Ferreira, J. A. P. Coutinho, A. M. Fernandes and M. G. Freire, *Separation and Purification Technology*, 2014, 128, 58-66.
29. P. Sharma and H. Kaur, *Applied water science*, 2011, 1, 135-145.
30. M. R. Malekbala, S. Hosseini, S. K. Yazdi, S. M. Soltani and M. R. Malekbala, *Chemical Engineering Research and Design*, 2012, 90, 704-712.
31. Z. Zhang, L. Moghaddam, I. M. O'Hara and W. O. S. Doherty, *Chemical Engineering Journal*, 2011, 178, 122-128.
32. N. Sharma and B. K. Nandi, *J. Mater. Environ. Sci*, 2013, 4, 1052-1065.
33. A. R. Harifi-Mood and F. Hadavand-Mirzaie, *Chemical Speciation & Bioavailability*, 2015, 27, 8-14.
34. Y. Xing and G. Wang, *Environmental technology*, 2009, 30, 611-619.
35. H. Dezhampanah, A. Mousazadeh and I. Mousazadeh, *European Chemical Bulletin*, 2014, 3, 400-406.
36. N. A. N. N. Malek, N. M. Sihat, M. A. Khalifa, A. A. Kamaru and N. S. Sani, *Jurnal Teknologi*, 2016, 78, 97-103.
37. A. A. Said, M. M. M. A. El-Wahab, S. A. Soliman and A. A. M. Aly, *2010 International Conference on Environmental Engineering and Applications*, 2010, DOI: 10.1109/ICEEA.2010.5596112, 154-156.

38. Y. Diquarternasi, *Malaysian Journal of Analytical Sciences*, 2009, 13, 185-193.
39. H. D. Utomo, R. Y. N. Phoon, Z. Shen, L. H. Ng and Z. B. Lim, *Natural resources*, 2015, 6, 209-220.
40. S. S. Azhar, A. G. Liew, D. Suhardy, K. F. Hafiz and M. D. I. Hatim, *American Journal of applied sciences*, 2005, 2, 1499-1503.
41. S. T. Akar, D. Yilmazer, S. Celik, Y. Y. Balk and T. Akar, *Chemical engineering journal*, 2013, 229, 257-266.
42. S. T. Akar, D. Yilmazer, S. Celik, Y. Y. Balk and T. Akar, *Chemical Engineering Journal*, 2015, 259, 286-292.
43. K. A. G. Gusmão, L. V. A. Gurgel, T. M. S. Melo and L. F. Gil, *Journal of environmental management*, 2013, 118, 135-143.
44. R. A. Fideles, G. M. D. Ferreira, F. S. Teodoro, O. F. H. Adarme, L. H. M. da Silva, L. F. Gil and L. V. A. Gurgel, *Journal of colloid and interface science*, 2018, 515, 172-188.
45. S. Mubarik, A. Saeed, M. M. Athar and d. M. Iqbal, *Journal of Industrial and Engineering Chemistry*, 2016, 33, 115-121.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 71 - 78 |

Spatial and Temporal Variations in Phycological Diversity Ganga at Bithoor Ghat, Kanpur

Vijay Tewari
Department of Botany, D.G. P.G. College, Kanpur (U.P.)
Corresponding author: vijaybotanydg@gmail.com

Abstract

Studies on the algal community in the river Ganga at Kanpur were made during Jan-2019 to Dec- 2019; revealed the evident spatial and temporal variations. The changes in the physico-chemical characteristics of the river water along with the variations in the algal profile were recorded. Observations recorded increases in a sequential manner from November to April and then with the onset of rains mark a slight decline. During the present course of investigation, spatial and temporal patterns of algal development are determined by Physico-chemical variables such as Temperature, Turbidity and Dissolved oxygen.

Keywords: Physico-chemical parameters, BOD, DO, Ganga River, Pollution level**.**

Introduction

The life of the Indo-Gangetic plains pulsates through Ganga as a perennial source of water from times immemorial. Whole of aquatic life depends directly or indirectly on the algal population as they constitute the primary producers of most fresh water bodies. Apart from forming an important food item of commercially important fishes (Pahwa & Mehrota, 1966), the algal communities have been extensively used as biological monitors from various parts of the world (Coste et al., 1991; Chessman et al., 1999; Atazadeh et al., 2007). There is evidence of algae as a source of pollution (Ingram and Palmer, 1952). While a considerable volume of literature exist depicting the pollution by changes in the physico-chemical parameters of a water body brought about by the addition of pollution by one or other source, there are as yet only few studies in which algae has been exploited as the biological indicators of pollution (Fogg, 1961; Palmer, 1957, 1969; Cholnoky, 1968; Kant, 1983). In the present study, an attempt has been made to correlate the different physical and chemical factors of the river water with the fluctuations in spatial and temporal distribution of algal communities.

Among the aquatic flora, diversity and distribution of microscopic flora is much greater having both

beneficial and harmful properties. Therefore, exploration of all forms of different community is warranted which is not possible to be studied by any individual. Enormous work on quantitative and qualitative along with taxonomic studies, indication of water pollution / environmental assessments and R & D studies using selected spp. have been carried out in different parts of India including Hooghly river (Gutpa and Sen, 1987; Banerjee, 1998; Sikdar and Keshri 2014), Kolkata (Biswas, 1925, 1926; Santra, 1987; Mitra and Gupta, 1994; Banerjee et al., 2001; Sen, 2006; Naskar et al., 2008) and so on. Pollutants bring about a change not only physico-chemical quality of water but also trigger a series of changes in biotic components of the ecosystem resulting in depletion of some of the valuable spp. (Srivastava, 2002; Dwivedi, 2020; Verma and Praksh, 2020; Kalal et al., 2021). Anthropogenic activities, prospects and aspects of pollution and its control, quality of water and public health hazards comprise major strength of the investigation (Jaiswal et al., 2009, 2010; Prakash and Verma, 2022).

Material & Methods

The sampling site Bithoor along the river Ganga were selected for the monthly collection of river water & algal samples. The investigations were carried out for one consecutive year, between Jan -2019 to Dec-2019. Some of the physico- chemical parameters of the river water such as Temperature, pH and DO were recorded at the sampling site itself while other chemical characteristics were analyzed with APHA (1995).

An exhaustive collection of algae from different sites of river Ganga at Kanpur was made with a view to record periodicity, succession, distribution and taxonomy of algae. Algal samples were collected in specimen tubes. They were then brought to the laboratory in living conditions and preserved in 4-5% formalin. Suitably stained preparations of algae were made On the basis of structures and measurements algae were identified using standard texts. Specimens were identified by consulting standard books, monograph (Geitler 1932; Tiffany and Britton, 1952; Desikachary, 1959; Prescott, 1982; Anand, 1989, 1998; Komarek and Anagnostidis, 2005).

Results & Discussion

A total number of 33 algal species spread over 13 chlorophyceae, 9 cyanophyceae, 11 bacillariophyceae were recorded from Ganga water of Bithoore Ghat. Algal infestation at this station been illustrated in Table 1 with special reference to major algae.

Qualitatively and quantitatively Chlorophyceae out number other classes of algae followed by Cyanophyceae and Bacillariophyceae. Observations recorded in Table indicate number of species recorded increases in sequential manner from November till May and then with the onset of rains marks a slight decline.

(+) Present a major algae, (-) = Not present as major algae. The result obtained from the observation made during January, 2019 to

December, 2019 on the various physico-chemical parameters included in this study shown in table 2.

Table-1 Major Algae observed at Bithoor Ghat

S.No.	Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
(A)	*Chlorophycaea*	+	+	+	-	+	-	-	-	+	+	+	+
1.	*Actinastrum hantzschii*	+	+	+	+	-	-	+	-	+	+	+	+
2.	*Ankistrodesmus falcatus var. acicularis*	+	+	+		-	-	-	-	+	+	+	+
3.	*Chlorella vulgaris*	+	-	+	+	-	-	-	-	+	+	+	+
4.	*Closteriopsis* spp.	+	+	+	+	-	-	-	-	+	+	+	+
5.	*Cladophora glomerata*	+	+	+	+	+	-	-	-	+	+	+	+
6.	*Hydrodictyon reticulatum*	+	+	+	+	+	-	-	-	+	+	+	+
7.	*Mougeotia sphaerocarpa*	+	+	+	+	+	-	-	-	+	+	+	+
8.	*Scenedesmus bijuga*	+	+	+	+	+	+	+	+	+	+	+	+
9.	*Scenedesmus armatus*	+	+	+	+	+	-	-	-	+	+	+	+
10.	*Scenedesmus acuiminatus*	+	+	+	+	+	-	-	-	+	+	+	+
11.	*Spirogyra gratiana*	+	+	+	+	+	+	+	-	+	+	+	+
12.	*Spirogyra mirabilis*	+	+	+	+	+	-	-	-	+	+	+	+
13.	*Zygnema tenue*	+	+	+	+	+	-	-	-	+	+	+	+
(B)	*Cyanophyceae*												
1.	*Anabaena*	+	+	+	+	+	-	-	+	+	+	+	+
2.	*Aphanocapsa*	+	+	+	-	+	+	-	-	-	+	+	+
3.	*Chroococcus tenax*	+	+	-	-	-	-	-	+	+	-	+	+
4.	*Gloeotrichia indica*	+	+	-	+	+	-	-	-	-	-	-	+
5.	*Merismopedia glauca*	+	+	-	+	+	+	-	-	-	+	-	+
6.	*Oscillatoria formosa*	+	+	+	+	+	-	-	+	+	+	+	+
7.	*Oscillatoria princeps*	+	+	+	+	+	-	-	+	+	+	+	+
8.	*Oscillatoria tenius*	+	+	+	+	+	-	-	+	+	+	+	+
9.	*Microcystis aeruginosa*	+	+	+	+	-	-	-	-	-	-	+	+
(C)	*Bacillariophyceae*												
1.	*Amphora ovalis*	+	+	+	+	+	-	-	+	+	+	+	+
2.	*Cyclotella*	+	+	+	-	-	-	-	-	+	+	+	+
3.	*Fragilaria crotonensis*	+	+	+	-	-	-	-	+	+	+	+	+
4.	*Gomphonema parvulum*	+	+	-	-	+	+	-	-	-	+	+	+
5.	*Gyrosigma scalproides*	+	+	+	+	-	-	-	+	+	+	+	+
6.	*Navicula gracilis*	+	+	+	+	+	-	-	+	-	+	+	+
7.	*Navicula tuscula*	+	+	+	+	+	-	-	+	+	+	+	+
8.	*Nitzschia*	+	+	+	+	+	+	+	-	-	+	+	+
9.	*Pleurosigma spencerii*	+	+	+	-	-	-	-	+	-	-	+	+
10.	*Synedra ulna*	+	+	+	+	+	-	-	-	-	-	+	+
11.	*Synedra ulna var. danica*	+	+	+	+	+	-	-	-	-	-	+	+

Table- 2 (Bithoor)

Parameters	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Temp. (ºC)	17	21	26	29	30	32	33	31	30	24	23	20
PH 8.12	8.48	8.44	8.14	8.40	8.65	8.04	8.20	8.04	8.08	8.02	8.55	8.50
DO (mg/l)	9.4	9.6	10.3	9.9	8.6	8.4	7.6	8.0	7.5	8.6	8.9	7.8

BOD (mg/l)	2.8	2.7	3.2	4.1	5.4	3.8	3.2	3.3	3.3	3.8	4.0	3.2
EC (mS/sm)	0.343	0.376	0.479	0.384	0.544	0.365	0.394	0.236	0.235	0.282	0.351	
TDS (ppm)	324	304	290	320	260	259	210	156	153	183	218	202
Alkalinity (ppı	220	192	196	140	216	220	164	178	110	212	264	337
Hardness (mg/	204	200	210	204	205	190	132	115	205	200	140	120
Chloride (mg/l	18	20	20	24	38	36	18	23	28	29	35	37

Pollution is the greatest crime of mankind against himself, with the rapid pace of industrialization. Effluents have posed a serious threat to the vast and varied resources of the country. Water quality of major river system is getting rapidly degraded due to massive discharges of municipal waste and industrial waste of diverse origin.

Present investigation has been carried out to examine the physical and chemical characteristics and level of pollution. Distribution of the physico-chemical parameters of water, such as Temperature, pH, DO, BOD, TDS, Conductivity, Alkalinity, and Hardness are influenced by both natural and anthropogenic stresses. Temperature is considered to be one of the most factors in an aquatic ecosystem (Welch, 1952). During the 1 year of investigation of present study, the water temperature has been varying between 17 °C-33 °C in this station. The maximum value of temperature was recorded in the month of July and the minimum in the month of January.

The pH of natural water is governed to the extent by the interaction of H ions released as a result of the dissociation of H2CO3 and OH ion produced the hydrolysis of bicarbonates. The pH value of water has been found to vary between 8.02-8.65. The maximum pH value was recorded in the month of May & Nov, the minimum in October.

Oxygen is present in water in a dissolved state. The oxygen content of fresh water varies with the season and also during the day and night. The level of oxygen content in an aquatic environment is dependent on the temperature, photosynthesis of autotrophs, respiration of biotic communities and organic load etc. The value of DO have been found to vary between 7.5mg/1-10.3mg/l. The maximum DO was recorded in the month of March and minimum in September. Higher DO value was observed during the winter were due to low temperature. This helped the water in holding more oxygen. The values of Biological oxygen demand (BOD) have been found to vary between 2.7mg/1 - 5.4mg/l. The maximum BOD was recorded in the month of November and May, the minimum in January and February.

The Electrical Conductivity (EC) as it is known, flows faster when a greater amount of salts are in the water. It is only dependent upon the concentration of nutrients. The values of EC have been found to vary between 0.235mS/cm-0.544mS/cm. the maximum value of EC was recorded in the month of May, the minimum in August to October.

Water, the universal solvent has large number of salts dissolved in it. It governs the physico-chemical properties and in turn has an indirect effect on the aquatic organisms (Prakash et al., 2015; Ashok, 2016). The value of total dissolve solids (TDS) have been found to vary between 153ppm-324ppm. The maximum value of TDS was recorded in the month of January, the minimum in September to October. The TDS is a mass estimate and is dependent upon the mix of nutrients as well as the concentration.

The alkalinity in water is usually caused by the Carbonate, Bicarbonate and Hydroxyl ions and less frequently by the Borates, Silicates and Phosphates. The values of total alkalinity have been found to vary between 337ppm-153ppm. The maximum alkalinity was recorded in the month of December, the minimum in June to September.

The values of hardness have been found to vary between 115mg/1-210mg/1. The maximum hardness was recorded in the month of March, January and July, the minimum in August to November in all stations. In most of the fresh water, the total hardness is imparted mainly by the Calcium and Magnesium ions which apart from Sulphates, Chloride and Nitrates are found in combination with Carbonates and Bicarbonates.

The values of chloride have been found to vary between 18mg/1 -38mg/l. The maximum value of chloride was seen in the month of November to December, the minimum in January to June. Human interference by bathing and cloth washing activities near to these stations resulted in input of detergents into the stream water, which may be responsible for the increase in chloride contents at the stations.

Acknowledgements

The Authors are thankful to Prof. Sadhana Singh, Principal and Dr. Archana Shrivastava, Head, Department of Botany, D.G.P.G. College, Kanpur for encouragements and facilities provided.

References

1. Anand N. (1989). Hand Book of Blue-Green Algae. Bishen singh Mahendra Pal Singh, Dehradun, India, pp. 79.
2. Anand N. (1989). Indian fresh water microalgae. Bishen singh Mahendra Pal Singh, Dehradun, India, pp. 94.
3. APHA (1995). Standard methods for the examination of water and wastewater. 19th edition, American Public Health Association, Washington, U.S.A.
4. Ashok K.V. (2016). Hydrobiological Studies of Muntjibpur Pond of Allahabad

(U.P.). International Journal on Agricultural Sciences. 7(2): 164-166.

5. Atazadeh I., Sharifi M. and Kelly M.G. (2007). Evaluation of the Trophic Diatom Index for assessing water quality in River Gharasou, western Iran. Hydrobiol., 589:165-173.

6. BAES (2004). District Statistical Handbook, Maldah. Bureau of Applied Economics and Statistic, Government of West Bengal, Kolkata, pp. 174.

7. Banerje Banerjee G. (1998). Survey of algae in habitats influenced by agro-chemical effluents and domestic sewage. Environment and Ecology16(1): 132-134.

8. Banerjee A. and Santra S.C. (2001). Phytoplanktons of the rivers of Indian Sunderban mangrove estuary. Indian Biologist 33(1): 67-71.

9. Banerjee G. (1997). Check list of algae in domestic sewage of Calcutta. Environm. Ecol. 15(3): 548-552.

10. Biswas K. (1925). Road slimes of Calcutta. Journal of the Department of Science of Calcutta University 7: 1-10.

11. Biswas K. (1926). Flora of Salt Lakes, Calcutta Journal of the Department of Science of Calcutta University 8: 1-47.

12. Bridson G.D.R. (2004a). Botanico-Periodicum-Huntianum (BPH - 2). 2nd Ed., 1(A-M): 1-819pp.

13. Bridson G.D.R. (2004b). Botanico-Periodicum-Huntianum (BPH - 2). 2nd Ed., 2(N - Z): 821-1470 pp.

14. Chessman B., Growns I., Currey J. and Plunkett-Cole N. (1999). Predicting diatom communities at the genus level for the rapid biological assessment of rivers. Freshwater Biol., 41:317-331.

15. Cholnoky W.W. (1968). Die Okologie der Diatomeen in Binnerge Wassrm,P.VIII and 699 J.Gramer Lohra.

16. Coste M., Bosca C. and Dauta A. (1991). Use of algae for monitoring rivers in france. In: Use of algae for monitoring rivers. (eds. B.A. Whitton, E. Rott, G. Friedrich). Innsbruck University, Innsbruck, pp. 75- 88.

17. Desikachary T.V. (1959). Cyanophyta Indian Council of Agricultural Research, New Delhi, pp.686.

18. Dwivedi S. (2020). Evaluation of Drinking Water Quality Status by Water Quality Index: A Case Study of Shikhar Water Fall, Dehradun (UK), India. *International Journal of Biological Innovations.* 2 (2): 214-219.

19. Fogg C. E. (1961). Physiology and Biochemistry of algae. Academic press, New York, 479-486.

20. Ingram, W. M. and C. Palmer (1952). Simplified procedures for collecting, examining and recording plankton in water. J. Amer, W. M. Ass.44: 617-624.

21. Geitler L. (1932.) Cyanophyceae. In: Rabenhorst, L. (ed.), Kryptogammenflora von Deutschalnd, Osterreich, under de Sweitz. Akad. Verlagsges, Leipzing 14: pp 1196.

22. Gupta D. and Sen C. (1987). Some Cyanophyceae from Gangetic delta of West Bengal - I. Hooghly District - A taxonomic enumeration. Journal of Economic and Taxonomic Botany 10(2): 381-385.

23. Jaiswal H. and Tewari V. (2009). Physico-Chemical Studies on Ganga Ecosystem at Kanpur (U.P.) in National Seminar on Recent Trends in Biological Scenario at Kanpur PP 65-67.

24. Jaiswal H., Singh. A and Tewari V. (2010). Status of Physico-chemical Analysis of Ganga water at Kanpur (U.P.). Life Scienece Bulletin 7(2) : 199-202.

25. Kalal V., Giri M.J., Baskar S. and Kuba R. (2021). Detection of Pollutants present in the surface water of Ayad River, Udaipur, Rajasthan. International Journal of Biological Innovations. 3 (1): 212-220.

26. Kant Sashi (1983). Algae as indicators of organic pollution. Advance in Applied Phycology I 76-86.

27. Komarek J.and Anagnostidis K. (2005.) Cyanoprokaryota 2nd Part : Oscillatoriales. In: Budel, B, L. Krientiz, G. Gartner & M. Schagerl (eds.), Susswasserflora von Mitteleuropa, Elsevier / Spektrum, Heidelberg 19(2): pp. 759.

28. Maity H. and Santra S.C. (1985). Blue-green algal flora of 24 Paraganas, West Bengal (India) Phykos 24: 46-51.

29. Mitra S. and Gupta D. (1994). The genus Nostoc Vaucher and Anabaena Bory from Greater Calcutta. Journal of the National Botanical Society 48: 77-80.

30. Naskar N.M., Naskar K.R. and Talai S. (2008). Occurrence of six species of Spirulina Turpin em Gardner from the coastal wetlands of North 24 Parganas District, West Bengal, India, Seshaiyana ENVIS on estuaries, mangroves, coral reefs and lagoons 16(1): 4-5.

31. Pahawa D.V. and Mehrotra S.N. (1966). Observations on fluctuation in the abundance of plankton in relation to certain hydrobiological condition of River Ganga. Proc. Nat. Acad. Sci. India, 36: 157-189.

32. Palmer C.M. (1957). Algae as indicators of pollution. Pub. Health. Service Pub. No. 60 U.S. Govt. Printing Office Washington D.C.

33. Prakash S. and Verma A.K.

(2022). Anthropogenic activities and Biodiversity threats. International Journal of Biological Innovations. 4(1): 94-103.

34. Prakash S., Verma A.K. and Prakash Sadguru (2015). Limnological Studies of Alwara Lake of Kaushambi (Uttar Pradesh). International Journal on Biological Sciences. 6(2):141-144.
35. Prescott G.W. (1982). Algae of the Western Great Lakes Area. Otto Koeltz Science Publishers, W. Germany. Pp. 977.
36. Santra S.C. (1987). Air borne algae of Calcutta Metropolis. Phykos 26: 71-74.
37. Sen C.R. (2006). Some Cyanophyceae from Greater Calcutta - I: A taxonomic enumeration. Journal of Economic and Taxonomic Botany 30(1): 885-890.
38. Sikdar J. and Keshri J.P. (2014). The Genus Oscillatoria Vaucher (Oscillatoriales: Cyanoprokaryota) in West Bengal, India. International Journal of Current Research and Review 6(21): 47-59.
39. Srivastava L. (2002). Physico-Chemical and Microbiological Characters of water. Daya Publishing House, Delhi, PP. 40-53.Tiffany L.H. and Britton M.E. (1952). The Algae of Illinois. The University of Chicago Press, Chicage, Cambridge University Press, London, pp. 397.
40. Verma A.K. and Prakash S. (2020). Limnological Studies of Semara Taal, A wetland of District Siddharthnagar (U. P.), India. Journal of Fisheries and Life Sciences. 5 (1): 15-19

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 79 - 82 |

Triple "R" method includes essential water saving steps

Neelam Bajpai
Assistant Professor Department of Zoology
Mahamaya Govt. Degree College, Kaushambi (U.P.)
Corresponding author: neelambajpai18@gmail.com

Abstract

Water is one of the natural resource of the earth which is important for all. Water resources are continuously degrading by anthropogenic activities (like domestic and agricultural waste) and industrial activities. The requirement of safe drinking water in almost all areas of the world has increased to a large extent and also everyone has been more concerned about how wastewater contamination affects the environment. Therefore, triple 'R' formula for water resources has become an essential practice in all parts of the world which means reduce, recycle and reuse. Reduce include systematic and decrease utilization of water in which conservation step is involved while recycle and reuse include treatment of waste water (such as chemical coagulation, adsorption, and activated sludge) or sewage water or some other steps for its further use and these steps have been recognized as one of the most important goal for all human beings.

Keywords: Reduce, reuse, recycle, grey water.

Introduction

Water is one of the natural resource of the earth which is important for all. Earth's majority is covered by saline water (oceans), however, only fresh water is suitable for living organism (fresh water resources include water moving into streams, rivers, lakes and groundwater). Water resources are continuously degrading by anthropogenic activities (like domestic and agricultural waste) and industrial activities. Although total earth water is constant, it goes through continuous hydrological cycle such as transpiration by vegetation, evaporation, precipitation, run off and other natural processes. The requirement of safe drinking water in almost all areas of the world has increased to a large extent over the last few decades. In recent years, the quality and quantity of water bodies are destroying due to industrial growth and urbanization which include municipal sewage and domestic wastes, industrial wastes, pesticides, detergents fertilizers, toxic metals, radioactive wastes etc. Water table is also facing serious threat because of over usage of water, climatic change, global warming and negligence

of people to use the water in proper way [1,2,3].

Large part of the world population will face shortage of water and the situation of water crises will occur. Therefore, triple ‘R’ formula for water resources has become an essential practice in all parts of the world which means reduce, recycle and reuse. Reduce include systematic and decrease utilization of water in which conservation and management steps are involved while recycle and reuse include treatment of waste water (such as chemical coagulation, adsorption, and activated sludge) or sewage water or some other steps for its further use and these steps have been recognized as one of the most important goal for all human beings. That is why it is important to find and start all water conservation solution and methods that are available today.

Water conservation measure is an action, behavioral change, technology, device or improved design or process implemented to reduce water loss. Huge amount of water is lost every year due to unattended leaks, using out dated appliances, excessive washing, showering and gardening and other house hold activities. What we can do to conserve water is turning off water tap while brushing, shaving, take shallow baths, reuse bathwater for heavy cleaning like that of cars etc., install dual flush in home, buy washing machine and dishwasher that have AAA ratings, use of faucet aerator (it brakes water flow into fine droplets to maintain wetting effectiveness while using less water), use of waterless car washer, use of infrared system in bathroom so that faucet stays on only when needed, use of saline water for irrigation, mulching, propagation of dry garden, soak pit construction, tree plantation. There is also a need to conserve water while irrigation because agriculture is the largest user of worlds fresh water resource consuming about 70% of fresh water. Some solutions to start water loss in agriculture are use of drip method (a method of irrigation utilizing small low flow emitters that are located at or above the plant root zone designed to reduce the quantity of water loss due to evaporation), over head irrigation pressurized system/ use of sprinklers (sprinklers can be of many types such as impact sprinklers, oscillating sprinklers, drip sprinklers and underground sprinklers), improved furrows, use of better canal system etc. [1,3,4,5,6,10].

Besides conserving the water there must be steps for management for water which include the activity of planning, developing, distributing and optimum use of water resource under defined water policies and regulations. It includes recycling of water, rain water harvesting and treatment of industrial and sewage waste water. Lets know some water management methods commonly used: In India National Environmental Engineering Research Institute (NEERI), Nagpur recommended some method to clean water. Domestic and industrial polluted water may be stored in large shallow pond for few days. Because of presence

of sun light and nutrients a healthy bloom of algae flourish along with bacterial colonies and therefore organic waste is digested by these bacteria, the rest water may then be used for irrigation [4]. In some countries water hyacinth (*Eichhornia crassipes*) and duckweeds (*Lemna* and *Wolffia* sp.) are used to treat waste water. These species not only treat domestic waste water but industrial waste water is also upgraded. Water hyacinth can absorb, accumulate and concentrate heavy metal like lead, cadmium, nickel etc from industrially waste water [4]. Rain water harvesting-rain water harvesting tanks are prepared for the collection of rain water. This water is then passed through pipe which has filters fitted in them. Gray water cycling, it involves capturing of used water (water collected from sinks, laundry etc except from toilet), for reuse for irrigation purpose, however it may require a second piping system [7]. A special indigenous water management system is used by Chakhesang tribe of Nagaland state known as ZABO (paddy cum fish culture) in which there is fish channel in rice fields. Desalinization is the removal of salt and other impurity of sea water either by distillation or by reverse osmosis and this method is being increasingly used to provide high quality water for drinking cooking and other domestic uses. Establishment of sewage water treatment plants or waste water treatment plants [8,9,10].

Besides above-mentioned actions public awareness and education on the importance of protection of the water resources help to meet social and economic needs. Awareness campaigns on existing regulations for conservation and management of water resources need to be conducted. Water is life and its conservation is necessary for the existence of entire biotic world including humans [11], however, indiscriminate anthropogenic activities increase the wastage of water and creating biodiversity threats [12]. Opportunities for interactions between communities, policy makers, regulating agencies, NGOs, scientists, etc. need to be increased. Appropriate strategies and decision making tools that would enhance the capabilities of professionals, Government, and non-government organizations to take up local and community level action programmes need to be developed. By following different conservation and management methods as well as public awareness we will be able to have fresh water as a sustainable resource and are capable to meet current and future demand of water. In future, the need to conserve water will become more and more crucial so that we would be able to conserve maximum water. Teaching to the public about importance of water conservation is utmost need in order to save this earth and to maintain quality of human life.

References

1. Kurunthachalam, S. K. (2014). Water conservation and sustainability- an utmost importance. Hydrology Current Research 5:e117

2. Peter, H. Gleick (1993) & World fresh water resources (1993). Water in Crisis: A Guide to the World's Fresh Water Resources, Oxford University Press, New York.
3. Kumar, S. K. (2013). Indian waters Past and Present. Hydrology Current Research.
4. Singh, H. R. (2001). Introduction to Animal Ecology and Environmental Biology. Vishal Publishing Company, Books Market, Old Railway Road, Jalandhar.
5. Sharma, P.D. (2014). Ecology, Microbiology, Animal Behavior, Pollution and Toxicology.
6. Vikers, A. (2002). Water use and conservation. Water Plow Press. P 434.
7. “Greywater: what it is, ways to treat it, ways to use it” (2000). http:// www.greywater.com
8. “How to conserve water and use it effectively”. (2010). Environmental Protection Agency http:// www.epa.gov/owow/NPS/nps-conserve.html
9. Kumari, M. and Singh, D. (2016). Water conservation: Strategies and Solutions. IJARR, 1(4), 2016; 75-79.
10. Soil and Water Conservation Techniques in Rainfed Areas Edited by: B. Krishna Rao, S. Annapurna, B. Renuka Rani, Z. Srinivasa Rao, K.Sunitha, M. Schin Dutt, S. K. Jamanal and V. Ramesh Edition: 2022.
11. Verma, A.K. (2018). Ecological Balance: An Indispensable Need for Human Survival. Journal of Experimental Zoology, India. 21 (1): 407-409.
12. Prakash, S. and Verma, A.K. (2022). Anthropogenic activities and Biodiversity threats. International Journal of Biological Innovations. 4(1): 94-103.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 83 - 91|

Floral and Faunal diversity in Uttar Pradesh

Jitendra Kumar[1]*, Amita Kanaujia[2]

[1]Department of Zoology, Government Degree College Pihani, Hardoi (U.P.), India
[2]Department of Zoology, University of Lucknow, Lucknow (U.P.), India
*Corresponding author: jkumar4683@gmail.com

Abstract

India has a rich and varied heritage of biodiversity encompassing a wide range of habitats. India ranks among the top ten species rich nations and show high endemism.On the basis of area, our State Uttar Pradesh is 4th largest state of India. It is rich in biodiversity, having various kinds of flora and fauna. Uttar Pradesh has 87 species of mammals, 358 species of birds, 77 species of reptiles, 25 species of amphibians, 152 species of fishes, 1460 species of arthropods, 47 species of molluscs and 1442 species of woody plants. Today, the biodiversity of Uttar Pradesh is gradually decreasing day by day and biodiversity is now mostly confined in national parks, wildlife sanctuaries and wetlands only. This depletion in biodiversity is due to habitat destruction and disturbances, hunting and poaching, various developmental projects such as barrages, bridges, highways, agricultural expansion, electrocution, excessive tourism, forest fire practices and scarcity of food. Therefore, most of species of flora and fauna become endangered or on the verge of extinction. Almost all species of animals are under threatened condition.

Keywords: Biodiversity, Flora and fauna, Electrocution, Endangered, Extinction.

Introduction:

India has a rich and varied heritage of biodiversity encompassing a wide range of habitats. Besides, India is recognized as one of the eight important centers of origin and diversity of crop plants. India ranks among the top ten species rich nations and show high endemism (Table 1). With only 2.4% of the world's land area, India accounts for 7-8% of recorded floral as well as faunal diversity of the world.

Table 1: Diversity of Flora and Fauna in India.

Group	Number of species	% of world species
Mammals	350	7.6%
Birds	1224	12.6%
Amphibians	197	4.4%
Reptiles	408	6.2%
Fishes	2546	11.7%
Flowering plants	15000	6%

A biodiversity hotspot is a bio-geographic region with a significant reservoir of biodiversity that is under threat from humans. India has 4 distinct biodiversity hotspots namely Western Ghats, Eastern Himalayas, Indo-Burma Region (North-east India) and Sundaland (Nicobar Islands). Our state Uttar Pradesh also has a rich diversity of animals and plants. This paper tries to reveal floral and vertebrate faunal diversity in Uttar Pradesh. The present paper also made some recommendations to protect and conserve their diversity.

Uttar Pradesh At A Glance:

Geographical area: 2,40,928 Km^2 (7.3% of the total area of the country)

Location: $23^0 52^I N$ - $30^0 24^I N$ latitude and $77^0 05^I E$ - $84^0 38^I E$ longitude

Boundaries: It is a land locked and 4th largest state of India, lying in north India. It is locked by state of Uttarakhand and the country of Nepal in north, state of Bihar in east, states of Jharkhand and Chhattisgarh in South-east, state of Madhya Pradesh in south and states of Rajasthan, Haryana and Delhi in west.

- Climate: The annual rainfall varies from 1000 mm – 1200 mm
- Temperature ranges between 5^0 during winter to 45^0 in summer

Population: 199.81 million (16.49% of the country, the most populous state in the country as per the census 2011)

- Rural population: 77.73%
- Urban population: 22.27%
- Tribal population: 0.57%
- Population density: 829 persons per Km^2

Major rivers: The Ganges and its main tributaries as Yamuna, Ramganga, Gomti, Ghaghara and Gandak from Himalayas. Chambal, Betwa, Ken and Son from Vindhya Range (Fig. 1).

Forests in Uttar Pradesh:

- Total forest and tree cover: 21,505 Km^2 (8.93% of total geographical area)
- Recorded Forest Area: 16,582 Km^2 (6.88% of its geographical area)
- Reserved Forests: 12,071 Km^2
- Protected Forests: 1,157 Km^2
- Un-classed Forests: 3,354 Km^2 (Fig. 2)

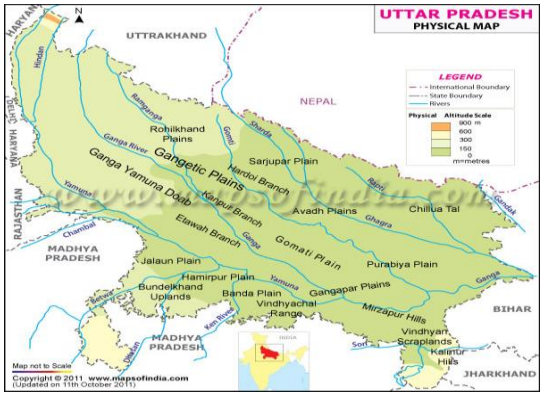


Fig. 1: Map of Uttar Pradesh

(Source: www.mapsofindia.com)

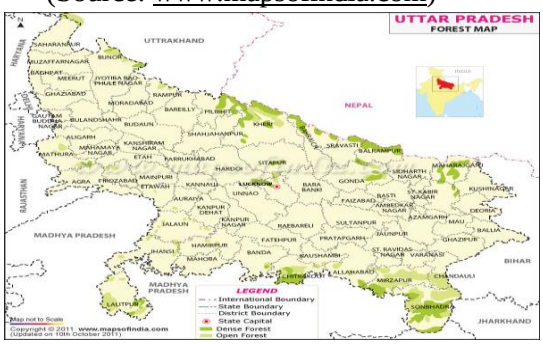


Fig. 2: Forest Cover in Uttar Pradesh

(Source: www.wealthywaste.com)

National Parks in Uttar Pradesh:

National Park is an area which is strictly reserved for the betterment of wildlife and biodiversity and where activity like poaching, hunting and grazing are not permitted. Uttar Pradesh has one National Park known as **Dudhwa Tiger Reserve**. Dudhwa Tiger Reserve comprises three protected areas i.e. Dudhwa National Park (660 Km^2), Kishanpur Wildlife Sanctuary (203 Km^2) and Katraniaghat Wildlife Sanctuary (550 Km^2). It is located on the Indo-Nepal border in the Palia and Nighsan Tehsils of district Lakhimpur-Kheri. It has various habitat types with 66 woodlands, 22 grasslands and 12 wetlands.

Wildlife Sanctuaries in Uttar Pradesh:

It is an area which is declared for the purpose of protecting and propagating wildlife and its environment. Certain rights such as collecting minor forest product, harvesting of timber and grazing are allowed for local people. In Uttar Pradesh, There are 25 Wildlife Sanctuaries (Table 2).

Table 2: Wildlife Sanctuaries in Uttar Pradesh.

S.No.	Name of Wildlife Sanctuary (WLS)	Established Year	Area (In km^2)
1	Bakhira WLS	1990	28.94
2	Chandraprabha WLS	1957	78
3	Dr. BhimraoAmbedkar Bird WLS	2003	4.27
4	Hastinapur WLS	1986	2,073.00
5	Kaimur WLS	1982	500.73
6	Katerniaghat WLS	1976	400.09
7	Kishanpur WLS	1972	227
8	Pilibhit Tiger Reserve	2014	730.24
9	Lakh Bahosi Bird WLS	1988	80.24
10	Mahavir Swami WLS	1977	5.41
11	National Chambal WLS	1979	635
12	Nawabganj WLS	1984	2.25
13	Okhala Bird WLS	1990	4
14	Parvati Aranga WLS	1990	10.84
15	Patna WLS	1990	1.09
16	Ranipur WLS	1977	230.31
17	Saman Bird WLS	1990	5.26
18	Samaspur WLS	1987	7.99
19	Sandi Bird WLS	1990	3.09
20	Sohagibarwa WLS	1987	428.2
21	Sohelwa WLS	1988	452.47
22	Sur Sarovar WLS	1991	4.03
23	Jai Prakash Narayan (Surhatal) Bird WLS	1991	34.32
24	Turtle WLS	1989	7
25	Vijai Sagar WLS	1990	2.62

(I) Vertebrate Faunal Diversity In Uttar Pradesh:

(A) Mammalian Diversity:

87 species of mammals are found in Uttar Pradesh such as Tiger (*Panthera tigris*), Leopard (*Panthera pardus*), Hyaena (*Hyaena hyaena*), Sloth bear (*Melursus ursinus*), Civets (*Civettictis civetta*), Mongooses (*Herpestesauro punctatus*), Langur (*Trachypithecus francoisi*), Jackal (*Canis aureus*),

Leopard cat (*Prionailurus bengalensis*), Fishing cat (*Prionailurus viverrinus*), Jungle cat (*Felis chaus*), Chital (*Axis axis*), Sambhar (*Rusa uniclor*), Barking deer (*Muntiacus muntjak*), Hog deer (*Axis porcinus*), Swamp deer (*Rucervus duvaucelii*), Elephant (Elephas maximus indicus), Hispid Hare (*Caprolagus hispidus*), one horned Indian Rhinoceros (*Rhinoceros unicornis*) and Rhesus Monkey (Macaca mulatta), Indian Flying fox (Pteropus giganteus), Little Indian Bat (Pipistrellus coromandra), False Vampire Bat (Megaderma lyra), Rat (Rattus rattus), Indian Hare (Lepus nigricollis).

(B) Avian Diversity:

Uttar Pradesh has a rich and varied avifauna. Over 550 species of birds have been identified and recorded in this state i.e. Cattle Egret (*Bubulcus ibis*), Black Kite (*Milvus migrans*), Shikra (*Accipiter badius*), Indian Peafowl (*Pavo cristatus*), Red Jungle Fowl (*Gallus gallus*), Red-wattled Lapwing (*Vanellus indicus*), Blue Rock Pigeon (*Columba livia*), Yellow-footed Green Pigeon (*Terron phoenicopera*), Spotted Dove (*Streptopelia chinensis*), Eurasian Collared Dove (*Streptopelia decaocto*), Little brown dove/ laughing dove (*Streptopelia senegalensis*), Rose-ringed Parakeet (*Psittacula krameri*), Asian Koel (*Eudynamys scolopacea*), Greater Coucal (*Centropus sinensis*), Brainfever Bird (*Hierococcyx varius*), Jungle Owlet (*Glaucidium radiatum*), House Swift (*Apus affinis*), White-throated Kingfisher (*Halcyon smyrnensis*), Common Hoopoe (*Upupa epops*), Brown-headed Barbet (*Megalaima zeylanica*), Coppersmith Barbet (*Megalaima haemacephala*), Grey Wagtail (*Motacilla cinerea*), Red-vented Bulbul (*Pycnonotus cafer*), Red-whiskered bulbul (*Pycnonotus jocosus*), Common Iora (*Aegithina tiphia*), Oriental Magpie Robin (*Copsychus saularis*), Indian Robin (*Saxicoloides fulicata*), Brown Rock Chat (*Cercomela fusca*), Jungle-Babbler (*Turdoides striatus*), Large Grey-Babbler (*Turdoides malcolmi*), Ashy Prinia(*Prinia socialis*), Plain Prinia (*Prinia inornata*), Red-throated Flycatcher (*Ficedula parva*), Purple Sunbird (*Nectarinia asiatica*), House Sparrow (*Passer domesticus*), Brahminy Starling (*Sturnus pagodarum*), Myna (*Acridotheres tristis*), Bank Myna (*Acridotheres ginginianus*), Asian Pied Starling (*Sturnus contra*), Chestnut-tailed starling (*Sturnus malabaricus*), Indian Grey Hornbill (*Ocyceros birostris*), Indian Tree Pie (*Dendrocitta vagabunda*), House Crow (*Corvus splendens*), Jungle Crow (*Corvus macrorhynchos*), Black Drongo (*Dicrurus macrocercus*), Eurasian Golden Oriole (*Oriolus oriolus*), Oriental White-eye (*Zosterops palpebrosus*). Besides these birds, 8 species of Vultures are also recorded of which 5 species are residential and 3 species are migratory. These are Egyptian Vulture (*Neophron percnopterus*), Long-billed Vulture (*Gyps indicus*), White-backed Vulture (*Gyps bengalensis*), Slender-billed Vulture (*Gyps tenuirostris*), King

Vulture (*Sarcogyps calvus*) and Griffon Vulture (*Gyps fulvus*), Himalayan Griffon Vulture (*Gyps himalayesis*), Cinereous Vulture (*Aegypius monachus*).

(C) Reptilian Diversity:

Mugger (*Crocodilus palustris*), Ghariyal (*Gavialis gangeticus*), Common Indian Monitor (*Varanus bengalensis*), Indian Python (*Python molurus*), Indian Rat Snake (*Ptyas mucosa*), Cobra (*Najanaja*), Russel 's Viper (*Daboia russelii*), Himalayan Pit Viper (*Gloydius himalayanus*), Common Krait (*Bungurus caeruleus*), Banded Krait (*Bungarus fasciatus*), Fresh Water Snake (*Enhydris enhydris*), Checkered Keelback (*Xenochrophis piscator*), Blind Snake (*Ramphotyphlops braminus*), Red Sand Boa (*Dyxjohnii*), Common Vine Snake (*Ahaetulla nasuta*), Common Kukri Snake (*Oligodon arnensis*), Common Cat Snake (*Boiga trigoncaa*), Indian Roofed Turtle (*Pungshura tectum*), Indian Tent Turtle (*Pungshura tentoria circumdata*), Indian Tent Turtle (*Pungshuraten toriallaviventris*), Brown Roofed Turtle (*Pungshura smithii*), Spotted Pond Turtle (*Geocletnys hamiltonii*), Crowned River Turtle (*Hardella thudii*), Three-striped Roofed Turtle (*Kachuga dhongoka*), Painted Roofed Turtle (*Kachuga kachuga*), Indian Eyed Turtle (*Morenia peters*), Indian Black Turtle (*Melanochelys tryuga*), Tricarinate Hill Turtle (*Melanochelys tricarinata*), Indian Soft-shell Turtle (*Aspideretes gangeticus*), Indian Peacock Soft-shell Turtle (*Aspideretes finnan*), Indian Flap-shell Turtle (*Lissemys punctata*), SmalI-headed Soft-shell Turtle (*Chitra indica*), Elongated Tortoise (*Hidotestudo elongata*).

(D) Amphibian Diversity:

In Uttar Pradesh, about 17 species of amphibians that belongs to 11 genera of 05 families are found in various habitats. Some are very common such as Common Indian Toad, *Bufo melanostictus*, *Bufo microtympanum*, *Bufo parietalis*, Asian Painted Frog, *Kaloula pulchra*, *Hyla annectans*, *Rana tigrina*.

(E) Fish Diversity:

In Uttar Pradesh, 115 species of fishes belonging to 72 genera of 27 families are found in ponds, streams, lakes and rivers of which 108 species are native and 06 species exotic. Some are very common such as Chikka (*Amblyceps mangois*), Chaguni (*Chagunius chagunio*), Moey (*Chitala chitala*), Tengra (*Glyptothorax caevia*), Menoda (*Hemibanarus menoda*), Nangra (*Nangra nangra*), Pabo (*Ompok pabo*), Mahasol (*Tor putitora*), Mahaseer (*Tor tor*), Goonch (*Bagarius bagarius*), Baghua (*Botia dario*), Nayan (*Cirrhinus mrigala*), Latia (*Crassochelius latius*), Vacha (*Eutropichthys vacha*), Silkota (*Garragotyla gotyla*), Telchita (*Glyptothorax telchitta*), Singhi (*Heteropneustis fossilis*), Pangus (*Labeo pangusia*), Pabda (*Ompokp abda*), Pangas (*Pangasius pangasius*), Cinnamon loach (*Pangio pangio*), Dhrahi (*Puntius chola*), Corsula (*Rhinomugil corsula*), Lorhia (*Sicamugil cascasia*), Silond (*Silonia*

silondia) Tengan (*Sperata aor*), Rohu (*Labeo rohita*), Catla (*Catla catla*), Mangur (*Clarias batracus*) and Channa (*Channa punctatus*) (Hegde, *et al.*, 2014 ; Kanaujia *et al.*, 2015)

(II) Domestic Animal Diversity In Uttar Pradesh:

Out of the total livestock population of the country (529.7 million), the state of Uttar Pradesh contributes 63.96 million livestock whereas the cattle population of the state is 19.09 million (Livestock Census 2007). Cattle are invaluable as they contribute in the form of milk, meat, organic manure and a variety of byproducts. There are various types of cattle, Cows (Kenkatha, Kherigarh, Ponwar and Gangatiri), Buffaloes (Bhadawari), Goats (Barbari and Jamunapari) and Sheep (Muzaffarnagri and Jalauni).

(iii) Floral Diversity In Uttar Pradesh:

The floral diversity of any area comprises trees, shrubs and herbs along with fruit orchards. In Uttar Pradesh, preliminary data indicates the following plant diversityas shown in table 3

Table 3: Floral Diversity in Uttar Pradesh.

S.N.	Groups of Plant	No. of species in World	No. of species in India	No. of species in Uttar Pradesh
1.	Algae	40,000	7,182	300
2.	Fungi	72,000	14,588	935
3.	Lichens	20,000	2,458	135
4.	Bryophytes	16,600	2,451	72
5.	Pteridophytes	10,000	1,236	44
6.	Gymnosperms	650	69	-
7.	Angiosperms	2,50,000	17,643	1442

Uttar Pradesh has a large dense forest area as well as a number of private orchards in which a tremendous diversity of plants are seen. Some common plant species are Khair (*Acacia catechu*), Babool (*Acacia nilotica*), Reonj (*Acacia leucophloea*), Haldu (*Adina cordifolia*), Bel (*Aegle marmelos*), Aru (*Ailanthus exelsa*), Akol (*Alangium salvifolium*), Kala Siris (*Albizia labbeck*), Dhau (*Anogeissus latifolia*), Dhaura (*Anogeissus pendula*), Neem (*Azadirachta indica*), Hingot (*Balanites aegyptica*), Kachnar (*Bauhinia variegate*), Semal (*Bombax ceiba*), Salai (*Boswellia serrata*), Dhak (*Butea monosperma*), Chilla (*Casearia elliptica*), Amaltas (*Cassia fistula*), Lasoda (*Cordia oblique*), Shisham (*Dalbergia sissoo*), Tendu (*Diospyros melanoxylon*), Bargad (*Ficus benghalensis*), Peepal (*Ficus religiosa*), Goolar (*Ficus glomerata*), Pakad (*Ficus virens*), Kateri (*Flacourtia indica*), Kharpat (*Garuga pinnata*), Anjan (*Hardwickia binata*), Dudhi (*Holarrhena antidysentrica*), Kanju (*Holoptelea integrifolia*), Sidha (*Lagerstroemia parviflora*), Jhingan (*Lannea coromandelica*), Rohini (*Mallotus philippensis*), Mahua (*Madhuca latifolia*), Mango (*Mangifera indica*), Kadamb (*Mitragyna parviflora*), Amla (*Phyllanthus emblica*), Sakhu (*Shorea robusta*), Kusum (*Schleichera oleosa*), Jamun (*Syzygium cumini*), Sagaun (*Tectona grandis*), Arjun (*Terminalia arjuna*), Bahera (*Terminalia bellerica*), Asna (*Terminalia tomentosa*) and Ber

(*Zizyphus mauritiana*) (Venkatraman *et al.*, 2011).

State Symbols:

Everybody have to think that why a Nation or State declare a particular animal or plant as symbol not even human? A nation or State declares its local flora and fauna as symbol to aware all people to protect and conserve their diversity. The state symbols of Uttar Pradesh are as follows:

- **Sarus Crane (*Grus antigone*)**

  The Sarus Crane is the tallest flying bird, having highest number in Uttar Pradesh in our country. This bird is the state bird of Uttar Pradesh (Verma et al., 2015; Verma & Prakash, 2017). Five districts of Uttar Pradesh namely Etawah, Aligarh, Etah, Kaushambi and Mainpuri alone harbor about one fifth of the world population of Sarus Crane (Fig. 3A).

- **Barasingha (*Rucervus duvacelii*)**

  The most striking features of a Barasingha are its antlers, with an average of 12 tines on a mature stag. It is found in the tarai especially in Kishanpur Sanctuary, Dudhwa National Park and Katarniaghat. Barasingha is the state animal of Uttar Pradesh (Fig. 3B).

- **Chital/Mohi (*Chitala chitala*)**

  It is commonly called as "Feather back", bears fancy spots (chitti) on its body. It has been recorded in Gomti, Gerua, Betwa and Yamuna rivers. Its maximum length is up to 150 cm. And weight about 14 kg (Fig. 3C).

- **Sita Ashok (Saraca asoca)**

  It is an evergreen tree with dense, spreading crown leaves belongs to the family Leguminosae and sub-family Caesalpiniaceae. The flowers are in orange- red clusters (Fig. 3D).

- **Dhak/Palash (Butea monosperma)**

  It is a slow growing deciduous tree belonging to family "Fabaceae". It has compound leaves with three large, leathery leaflets. Its flowers yield an orange dye (Fig. 3E).

Fig. 3A: Sarus Crane

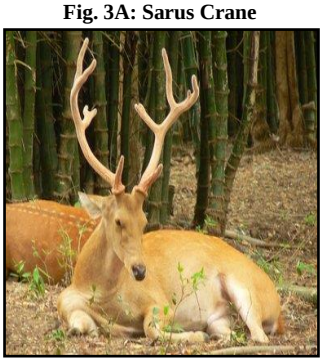


Fig. 3B: Barasingha

Fig.3C: Sita Ashok

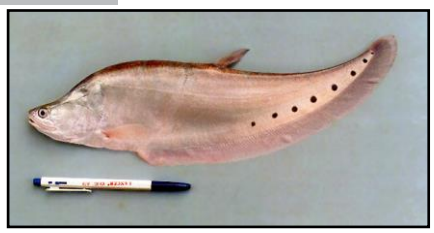


Fig. 3D: Chital/Mohi

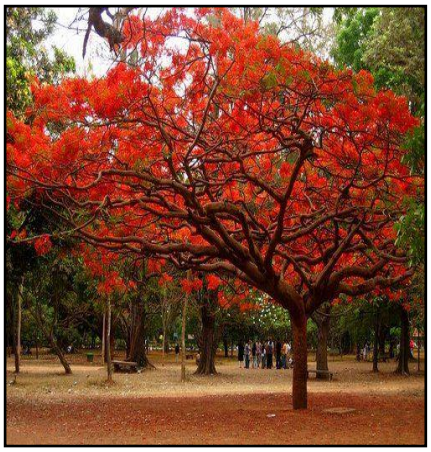


Fig. 3E: Dhak/Palash

Conclusion:

- Uttar Pradesh is rich in biodiversity, having various kinds of flora and fauna. Uttar Pradesh has 87 species of mammals, 358 species of birds, 77 species of reptiles, 25 species of amphibians, 152species of fishes, 1460species of arthropods, 47 species of molluscs and 1442 species of woody plants. Today, the biodiversity of Uttar Pradesh is gradually decreasing day by day and biodiversity is now mostly confined in national parks, wildlife sanctuaries and wetlands only. This depletion in biodiversity is due to habitat destruction and disturbances, hunting and poaching, various developmental projects such as barrages, bridges, highways, agricultural expansion, electrocution, excessive tourism, forest fire practices and scarcity of food. Therefore, most of species of flora and fauna become endangered or on the verge of extinction. Almost all species of animals are under threatened condition. I think that the basic reason of depletion of biodiversity is the increasing distance between human and nature. The relation between human and nature is not remaining healthy. Humans are so busy and have no time to think about their nature its conservation. They know only the exploitation of nature at any rate for their development. There is need of time to protect and conserve our biodiversity following some recommendations-

- There should be sustainable development and conserve their biodiversity for next generations.
- Habitat management includes not only conserving their habitats but also conserve their sources of food.
- There should be need to aware local people to protect and conserve the environment for native flora and fauna.
- Forest policies and guidelines should include control measures for anthropogenic environmental degradation that poses threat to survival of flora and fauna.
- The present study also recommended introduction of well insulated electric power lines, safe and protected railway tracts. These are the possible measures which may reduce the mortality among animals due to electrocution and train accidents.

- Make an effort to change the attitudes of local people towards biodiversity through a variety of awareness programmes aimed at local people of different ages and in different strata of society because all animals also have Rights to live freely with their natural recourses.

References:

1. *Hegde, V.D. & Venkatraman, K. (2014). Inventory of Faunal Diversity of Uttar Pradesh, published by Uttar Pradesh State Biodiversity Board, Lucknow pp 23-26.*
2. Kanaujia, P.R., Singh, P., Kanuajia, A. and Pal, N. (2015). Biodiversity Conservation Education for Sustainable Development: Biodiversity of Uttar Pradesh on Wheels. *Published by Uttar Pradesh State Biodiversity Board, Lucknow, pp 31-33.*
3. *Nayaka, S. & Upreti, D.K. (2013). Lichens of Uttar Pradesh, published by Uttar Pradesh State Biodiversity Board, Lucknow pp 24-35.*
4. *Saini et al. (2011). Floristic Diversity of Uttar Pradesh with special reference to Eastern Uttar Pradesh published by Uttar Pradesh State Biodiversity Board, Lucknow pp 156-160.*
5. *Venkatraman, K. (2011).* Conservation of Forest Biodiversity in India. *Published by Uttar Pradesh State Biodiversity Board, Lucknow, pp 1-8.*
6. Verma, A.K. & Prakash, S. (2017). Sarus Crane: An Eternal Symbol of Marital Fidelity. International Journal of Zoological Investigations. 3(1): 11-14.
7. Verma, A.K., Prakash, S. & Kumar, S. (2015). Status and Ecology of Indian Sarus Crane, *Grus antigone antigone* in and around the Alwara Lake of District Kaushambi (U.P.). International Journal on Environmental Sciences. 6(2): 331-335.
8. www.mapsofindia.com
9. www.upsbdb.org
10. www.wealthywaste.com

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 92 - 94 |

Bird Biodiversity in Bharath Nagar, Bengaluru

Madhura Bhat U., Asheera Banu Sangli*, Ganesh U.
Department of Zoology
MES College of Arts Commerce and Science, Malleshwaram, Bengaluru (Karnataka)
*Corresponding author: asheerabs@gmail.com

Abstract

The birds are found in the biodiversity parks, forest areas, deserts, sanctuary, national parks, in and around lakes and rivers. The birds are residents, endemic, endangered, regular or irregular migrants. These are of various types and having different food habits and find their habitat where they find food and breeding place. Identification of bird is usually done by feather colour, plumage, beak shape and size, body size, home building. Bird watchers usually go for watching birds in biodiversity parks, forest areas, sanctuaries, natural habitats, lakes or rivers. Bird watching is a recreation, hobby or educational study. Now a days best quality cameras and equipment are used to capture the picture of the bird or sometimes even draw picture of the birds they observe. In our study bird watching was done around Bharath Nagar Lake, Bengaluru, Karnataka, India.as we find diversity of birds in that area, Different birds were spotted and photographs and list of the birds spotted were made. Bharath Nagar lake area is in urban Bengaluru and during rainy season lake will be filled with water and during summer season water level will be less but around the lake it is green belt rich with shrubs, herbs, trees, and provides water, natural food, shelter and breeding ground for birds.

Keywords: Bird biodiversity, Bird watching, Bharath Nagar area.

Introduction

Birds are feather clad vertebrates belonging to class Aves and are found in different places throughout the world and occupy the habitat where they can breed, find food and shelter (Verma and Prakash, 2020). Birds are flying vertebrates with various coloured plumage, sizes, food habits. Habitats. Bird watchers spot and watch their feeding behaviour, nesting behaviour, courtship behaviour and capture their photographs, record them and do survey of the birds, In this study bird watching was done in and around Bharath Nagar lake Bengaluru Karnataka, India. Bengaluru is one of the fastest growing urban city but some part of Bengaluru is still not intervened by people and still remains covered with green belt and hence called green city. The places like Bharath Nagar Lake area is still lust green with many different types of trees,

shrubs, herbs and grass having natural food and place for birds, So different types of birds are spotted in this area, people come here for recreation and do bird watching also. We have done bird watching for nearly a year from January 2022 to November 2022 and were able to capture different types of beautiful birds.

Bird watching or birding is a hobby where people stare and observe birds in the wild in their natural, home environment. People have been spotting, watching, and studying birds for hundreds of years. Trying to find out more about the many different types of birds we see today. Bird watchers of today identify the birds. They spot by taking pictures or drawing sketches of them, one of the most famous bird watchers was John Audubon. (educheer.com research -papers bird-watching) A pair of binoculars or a telescope makes the bird seem closer to you, making you able to see the closeup details of the bird. While on a bird watching trip, many people bring a pair of binoculars or a telescope. (Jocelyn Alberto Floresco, 2015).

Methods

Bird watching was done around Bharath Nagar Lake, Bengaluru, Karnataka, India. Different types of birds were spotted, observed and beautiful pictures were captured by using Nikon Coolpix L830 camera and the birds were identified and recorded (Ali, 1998). The list of birds identified is given in table-1.

Results And Discussions-

This article is aimed to report the list of birds observed and photographs of birds observed during bird watching were taken in and around Bharath Nagar lake area. During observations different types of migratory birds and resident birds were present and we came to know that there were existence of different avian species found that area. The list of avian species spotted during birding is given in table 1.

Table 1: List of birds spotted

Sl. No.	Common Name	Scientific name
1.	Purple rumped sunbird	*Leptocoma zeylorica*
2.	Green sand piper	*Tringa ochropus*
3.	Asian koel	*Eudynamys scolopaceus*
4.	Scaly breasted mania	*Lonchura punctulate*
5.	Rose ringed parakeet	*Psittacula krameria*
6.	Red vented bulbul	*Pycnonotus cafer*
7.	Cinerous tit	*Parus cinereus*
8.	Red breasted fly catcher	*Ficedula parva*
9.	Common myna	*Acridotheris tristis*
10.	Indian spot billed duck	*Anas poecilorhyncha*
11.	Indian robin	*Copsychus fulicatus*
12.	Oriental magpie robin	*Copsychus saularis*
13.	Indian white eye	*Zosterops palpebrosus*
14.	Grey headed swamphen	*Porphyrio poliocephalus*
15.	Black kite	*Milvus migrans*
16.	Ashy prinia	*Prinia socialis*
17.	House sparrow	*Passer domesticus*
18.	White	*Halcyon smyrnensis*

	throated kingfisher	
19.	Ashy drongo	*Dicrurus leucophaeus*
20.	Spotted dove	*Streptopelia chinenis*
21.	Shikra	*Accipiter bodius*
22.	Little grebe	*Tachybaptus ruficollis*
23.	Indian golden oriole	*Oriulus kundoo*
24.	Eurasian moor hen	*Gallimula chloropus*
25.	Indian pond heron	*Ardeola grayii*
26.	Cattle egret	*Bubulcus ibis*
27.	Black headed ibis	*Threbkiornis melanocephalus*
28.	White breasted water hen	*Amaurornis phaenicurus*
29.	Green bee eater	*Merops orientalis*
30.	Little egret	*Egretta garzetta*
31.	White checked barbet	*Psilopogon viridis*
32.	Greater caucal	*Centropus sinensis*
33.	Jungle myna	*Acridotheres fuscus*
34.	Red whiskered bulbul	*Pycnonotus jocosus*
35.	India pea fowl	*Paro cristatus*
36.	Pale billed flower pecker	*Dicaeum erythrorhynchos*
37.	Brown shirke	*Lanius cristatus*

Bird watchers have been watching birds around the world have been working on it and different birds were reported in Baguio city and Benguet province wherein 26 of which are endemic, 39 resident, 23 migrant and Migrant/Accidental are 2 as of this date (Jocelyn Alberto Floresco 2015). Birds are heavily populated life forms on the planet, and that biodiversity have led to a richness of life and beauty. Avitourism helps birdwatchers to study about the birds (Rochelle et al., 2015; Cagan, 2022) In our study we were able to identify some of the bird species in Bharat Nagar area of Bengaluru as detailed above.

References

1. Ali S. (1998). The Book of Indian Birds. Oxford University Press.
2. Cagan H. Sekercioglu (2022). Impacts of birdwatching on human and avian communities. Environmental conservation. 9(3):282-289.
3. Jocelyn Alberto Floresca (2015). Bird Watching as a Recreation and Nature Activity in Baguio City and Nearby Municipalities of Benguet Province Philippines: A Conservation Effort. Asian Journal of Applied Sciences. 03 (03):388-396.
4. Rochelle Steven, Clare Morrison and J. Guy Castley (2015). Birdwatching and avitourism: a global review of research into its participant markets, distribution and impacts, highlighting future research priorities to inform sustainable avitourism management. Journal of Sustainable Tourism. 23 (8-9): 1257-1276.
5. Verma A.K. and Prakash S. (2020). Status of Animal Phyla in different Kingdom Systems of Biological Classification. International Journal of Biological Innovations. 2 (2): 149-154.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 95 - 101 |

Livestock Biodiversity: Urgent Need for Conservation

Devendra Swaroop
C.S.A. University of Agriculture and Technology, Krishi Vigyan Kendra, Mainpuri (U.P.)
Corresponding author**:** dswaroopcsa@gmail.com

Abstract

The term biodiversity refers to the wealth of the Earth i.e., the millions of plants, animals and micro- organisms that live on our earth, the genes they contain and often delicate ecosystem they formulate. Biodiversity broadly refers to the variety of life forms, from genes to species to broader scale of ecosystem. In other words, it means variety and variability among living organisms, their genetic differences and the ecosystem in which they live. India is bestowed with rich domestic animal biodiversity having around 61 breeds of cattle, 20 breeds of buffalo, 29 breeds of goats, 59 breeds of sheep, 8 breeds of camel, 6 breeds of horses, 3 breeds of pig and 18 of poultry. Besides, there are other species like Equine, Mithun, Yak, Turkey, Ducks, etc.

Keywords: Biodiversity, Breeds, conservation, Genetic resources, Livestock, Species.

Introduction

India is one of the World's richest countries in terms of its vast array of biodiversity. Biodiversity forms the foundation for sustainable development. It is the basis for the environmental health of our planet and the source of economic and ecological security for future generations (Awasthi et al., 2017). Biodiversity supports many ecosystem services that are often not readily visible; it plays a part in regulating the chemistry of our atmosphere and water supply (Pandey, 2019). Biodiversity is directly involved in water purification, recycling nutrients and providing fertile soils. Biodiversity is a modern term which simply means "The variety of life on Earth" this variety can be measured on several different levels.

Livestock biodiversity is integral to our rural livelihood, culture, history, environment, economy and most importantly, our future (Swaroop, 2020). The diversity of livestock is not accidental, nor is it purely natural: the range of livestock is the outcome of thousands of years of deliberate selection, exposure to a range of natural condition and farmer level selective breeding. Thousands of livestock breeds, from relatively small genetic pools, have evolved over time to suit particular environments and farming systems. But out of thousands species of animals, only 40 species were found useful for

domestication by different settlements. Fewer than 14 of these 40 species account for as much as 90 percent of global livestock production of which the major domestic animals are seven mammalian species like cattle, buffalo, goat, sheep, pig, horse and ass and four avian species like chicken, duck, geese and turkey. It is estimated that domestic animal genetic resources contribute to about 30 percent of total human requirements for food and agriculture, either directly or indirectly. They meet various requirements of human being like meat, milk, egg, fibre, fertilizer for crops, draught power etc. Besides, it also reduces farmers' exposure to risk and employs almost 8 percent of total Indian Workforce.

"Biodiversity" broadly refers to the variety of life forms, from genes to species to broader scale of ecosystem. In other words, it means variety and variability among living organisms, their genetic differences and the ecosystem in which they live (Dogra and Thakur, 2011). The biodiversity has different levels, needs and values (Verma, 2015, 2016). An ecosystem needs three kinds of diversity *namely* biological, genetic and functional. Biological diversity refers to the richness of species in a particular area; genetic diversity refers a way for a particular species to adapt itself to changing environments while functional diversity equates to the biophysical processes that happen within the area. The genetic diversity acts as a buffer for biodiversity (Verma, 2017a). The biodiversity helps in maintaining the ecological balance. There is a necessity of ecological balance for widespread biodiversity and human survival (Verma 2017b, 2018). The climate change has a huge impact on biodiversity (Prakash and Srivastava, 2019; Verma, 2021) and farmers' practices (Mandal and Singh, 2020). It is necessary for inclusive and sustainable development to conserve the biodiversity that are influenced by anthropogenic activities (Verma, 2019; Prakash and Verma, 2022).

The diversity of livestock genetic resources is very wide, both in variety and variability in terms of species, breeds, populations and unique Genotypes. Judicious utilization and enhancement of the quality of these resources is important to ensure their sustainability to meet the future demands. Livestock - keeping communities have played a crucial role in the development of most of worlds local breeds and continue to be the custodians of these breeds.

Livestock keepers are mixed crop - livestock farmers, pastoralists, and landless livestock keepers from indigenous and non- indigenous communities (Pan, 2010). They have either a long - standing cultural associations with their livestock over many generations and have developed their breeds in interaction with a specific territory or landscape, or they sustain their animals and the environments where these animals live, relying largely on natural vegetation or home-grown fodder and crop by products and without artificial feed activities. Traditional

societies everywhere have consciously shaped breeds to their needs and wants, contrary to ethnocentric beliefs among many animal scientists that livestock in developing countries evolved without human interventions. This diversity is a vital resource for sustenance of mankind, both at present as well in future, through judicious exploitation, utilization and conservation to meet our food and nutritional security.

Global Biodiversity an Overview:

Among some 10 million species of living organisms on earth, 0.5 percent belongs to birds and mammals within this small fraction of animal biodiversity there are about 40 mammalian species that has been domesticated for food and agricultural production and another 80 species still exists as there wild relatives. Only 14 animal species are economically important, among these 14 species around 4000-5000 breeds have been developed for specific uses. However, this animal biodiversity is declining at a fast rate with some 30 percent of the total breeds evolved having got lost during the 20th century and many more breeds presently are threatened with extinction.

Livestock Diversity of India:

India is a mega-biodiversity in the world and maintains more than its proportionate share of livestock breeds. Approximately 6 percent of the total domestic animal biodiversity exists in India. As per the Food and Agricultural Organization (FAO) , data base there are 61 cattle breed, 19 buffalo breeds,59 sheep breeds, 29 goat breeds , 3 pig breeds, 3 ass breeds , 6 horse breeds, 8 camel breeds and 18 poultry breeds in India. Over the years, indigenous breeds of livestock were put under the pressure of natural and artificial selection by stakeholders for traits of their need i.e disease resistance, poor roughage based feed efficiency, ability to withstand natural disaster and migration etc. The important factors that contributed to diversity of animal genetic resources in India are: migration, settlement pattern and sharing of genetic resources by human beings resulting in widespread distribution of most important livestock species, market forces, food habit, changing lifestyle, preferences of local population for production and services.

Different Livestock Species Population:

As per the 20th Livestock Census 2019, India has a total livestock population of 535.78 million showing an increase of 4.6 percent, over the livestock census of 2012, and is a home of about 11.54percent of the total livestock population in the world. The total livestock population of Cattle, Buffalo, Sheep, Goat, Pig, Horse and Ponies, Mules, Donkeys, Camels, Mithun and Yak in the country was 512.05 million in 2012. The total number of milch animals, cows and buffaloes has increased from 118.59 million to 125.34 million, with an increase of 6.0 percent. The sheep and goat population presently is 74.26 million and 148.88 million shown an increase of 14.10 percent and 10.01 percent respectively over the previous census. The total number of

poultry in the country during 2012 was 729.21 million has reached to 851.81 million, which has shown an increase of about 16.81 percent.

Breeds of Buffalo:

Buffalo also known as "Milk-machine" is a premier dairy animal of India and holds the greatest promise and potential for milk, meat and draught. Buffalo has been rightly christened as a black gold mine of India and greatly helps the country to assess their strengths and potential to harness the nature's gift. India is fortunate in terms of largest buffalo population with 109.85 million during 2019, has shown an increase of 1.1 percent over 2012 census. (56.7 percent of world's buffaloes), Buffalo germ plasm diversity (13 recognized plus about 17 lesser-known defined population groups) and world' best milch breeds are: Murrah, Mehsana, Jaffrabadi, Banni and Nili- Ravi.

Breeds of Cattle:

As per the livestock census 2019 country has 192.49 million cattle compromising of 35.94 percent of total livestock. India has 37 registered pure indigenous, cattle breeds. Five of these Shahiwal, Gir, Red Sindhi, Tharparkar and Rathiare known as milch breeds. A few others, such as Kankrej, Ongole and Hariana, belong to dual purpose breeds that have both milch and drought qualities. There are several lesser known (non-descript) breeds. India over the past few decades, imported several exotic cow varieties to gain a boost in milk production. These breeds produce a lot of milk, but are not well adapted to Indian conditions. On the basis of their utility, cattle breeds are classified into five types :(1) Dairy type breed - 4, (2) Draft type-18, (3) Dual purpose-8, (4) Crossbred-6, (5) Lesser known breeds-13.

Breeds of Sheep:

The sheep breeds have been classified on the basis of Agro- economical regions viz., (A) North temperate region (B) North Western arid and semi arid region (C) Southern Peninsular region (D) Eastern region. Out of the registered thirty nine sheep breeds, some of the important breeds are: Balangir, Bellary Bhakarwal, Changthangi, Chokla, Chota nagpuri, Coimbatore, Deccani, Gaddi, Ganjam, Garole, Jaisalmeri, Jalauni ,Kenguri, Magra, Marwari, Mecheri, Muzzafarnagri, Nali, Nellore, Nilgiri, Patanwadi, Poonchi, Ramnad white ,Shahbadi, Sonadi, Tibetian, Vembur etc. The sheep population in India is estimated to be about 74.26 million (2019 census) ranking sixth in the world.

Breeds of Goat:

Goats also known as "Poor man's cow" have been an integral component of farming system and support a large rural population of landless and migrant farmers. On the basis of Agro- climatic conditions, Western Himalayan region covering Jammu and Kashmir, Himanchal Pradesh, Uttara khand and hilly areas of Punjab has temperate climate with heavy snowfall in winter. Chegu, Changthangi and Gaddi are the major goat breeds found in this region. Eastern Himalayan region covers

mountainous areas of Assam, West Bengal and north east sates. Dry Northern regions, plains of Punjab Haryana, Delhi, Rajasthan, Gujarat, Uttar Pradesh, Northern Madhya Pradesh and Mahrashtra. This zone is gifted with valuable 11 goat breeds accounting to 33 percent goat population of the country. Goats of this region are mostly of dual type and medium to large in size. Eastern region covers the states of Bihar Jharkhand, West Bengal, Assam and Orissa. Bengal and Ganjam are the major meat type goat breeds and low milk yielders. Sourthern arid/ semi-arid regions cover plateau and plain regions of M.P., Maharashtra, A.P., Tamil Nadu, Karnataka and Kerala. Osmanabadi, Sangamneri, Kanni adu, Malabari and Attapaddy are major meat type goat breeds.

Breeds of Pig:

About 1.7 percent of the total livestock is contributed by pigs India has 9.06 million pigs with 1.90 million exotic / crossbreeds and 7.16 million indigenous / nondescript breeds. The total population has decreased by 12 percent over previous census 2012. Major registered breeds are Ghoongro and Niang megha.

Breeds of Camel:

India has around 0.25 million camel, surprisingly the population has given decreasing trend of 37.05 percent, as the population during 2012 census was 0.40 million. The major registered six breeds of camel are Bikaner, Jaisalmeri, Jalori, Kutchi, Malvi, Marwari, Mewari and Mewati.

Breeds of Horse, Pony, Mule and Donkey:

The total population of horses, ponies, mules and donkeys has drastically decreased by 51.9 percent over previous census 2012. Presently population of horses, ponies, mules and donkeys in the country is 0.55 million. Major registered breeds of horse and pony are Bhutia, Kathiawari, Manipuri, Marwari, Spiti, Zanskari, and of donkey is Spiti whose home tract is Himachal Pradesh.

Production at A Glance:

India ranks first in milk production, achieving an annual output of 176.3 million tons during 2017-2018 as compared to 137.69 million tons during 2013-2014, recording a growth of 6.62 percent. The per capita availability of milk in India has increased from 176 grams per day in 1990-1991 to 375 grams per day during 2017-2018, which is more than the World average of 294 grams per day and 280 grams per day as recommended by ICMR.

Need For Conservation:

The last few decades have witnessed serious erosion, and even extinction of some indigenous livestock breeds in the country. Many existing breeds are facing varying degrees of that endangerment and are heading towards eventual decimation. In all the states, crossbreeding of cattle is now occupying a dominant position in the production programme and in the process the native

cattle breeds which are well adapted have suffered willful neglect resulting in their progressive elimination from the production system. It has also been noted that indigenous breeds are more efficient in feed conversion particularly the crop residues and naturally available low quality roughages. Hence, there is an urgent need for preserving the biodiversity and conservation of breeds endangered of extinction.

Conclusion:

Biodiversity supports many ecosystem services that are often not readily visible; it plays a part in regulating the chemistry of our atmosphere and water supply. Biodiversity is directly involved in water purification, recycling nutrients and providing fertile soils. The diversity of livestock is not accidental, nor it is purely natural, the range of livestock is the outcome of thousands of years of deliberate selection, exposure to a range of natural condition and farmer level selective breeding. India accounts for only 1/40th of the total land area of the world it possesses around 11.54 % of the world livestock population.

India is a mega biodiversity in the world and maintains more than its proportionate share of livestock breeds. Indian farmers, for centuries, have continuously modified the genetic material available to them by following simple but meticulous breeding schemes from generation to generation. Apart, from physical and biological adaptation forced by the environment, the economic, cultural, religious and survival factors have also played a role in this diversification.

Different livestock breeds were adapted to diverse local conditions. For instance, India has sheep breeds that are adapted to the harsh summers of the West Indian Desert and others that can survive equally harsh winters of Himalayan tracts. There are cattle breeds which thrive in humid hills of the Western Ghats, while other breeds do well in the driest regions of Rajasthan and Gujrat. India is bestowed with rich domestic animal biodiversity having around 61 breeds of cattle, 20 breeds of buffalo, 29 breeds of goats, 59 breeds of sheep, 8 breeds of camel, 6 breeds of horses, 3 breeds of pig and 18 of poultry. Besides, there are other species like Equine, Mithun, Yak, Turkey, Ducks, etc. Indigenous breeds /types are rich in variability and are endowed with many positive traits like superior disease resistance, better tolerance to high heat and humidity and other characteristics suitable to particular agro-climate environments.

References

1. Anonymous (2004). Compendium, Winter school on Sustainable Livestock Production, November 24- December 14, 2004 at MPKV, Rahuri, Ahmad Nagar, Maharashtra.
2. Anonymous (2010). Compendium, National Symposium on Technology Management, Visioning and Up-scaling for Accelerating Livestock Production,

November 11- 13, 2010 at COVS, AAU, Guwahati.

3. Anonymous (2011). Compendium, National Symposium on Emerging Management Concepts for Sustainable Livestock and Poultry production, November 02-04, 2011 at COVS, GADVASU, Ludhiana.
4. Anonymous (2017). Compendium, Winter school on Feeding Strategies in Relation to Climate Resilient forage and Livestock Production, September 05-25, 2017 at ICAR-IGFRI, Jhansi, U.P.
5. Awasthi A.K., Tripathi S.K. and Mishra U.S. (2017). Biodiversity: Its need and Conservation Emerging Trends in Agricultural, environmental and Rural Development Challenges and Solution Published by SBSRD, Allahabad, U P. PP 80-89.
6. Pandey A. (2019). Biodiversity Conservation and Human Health, Innovations in Agriculture, Environment and health Research for Ecological Restoration, Published by SBSRD, Allahabad, U P. PP 220-223.
7. Prakash S. and Verma A.K. (2022). Anthropogenic activities and Biodiversity threats. International Journal of Biological Innovations. 4(1): 94-103.
8. Swaroop D, Vaish S. and Prakash T. (2014). Souvenir and Abstracts, 2nd UP Agricultural Science Congress published by: UPCAR, Lucknow, U.P. Pp 59-64.
9. Swaroop D., Katiyar A. and Singh R.K. (2019). Souvenir and Abstracts National Symposium on Innovations in Agriculture, Environment and Technology for Inclusive Development, published by SBSRD, Prayagraj, U. P.
10. Swaroop D. (2020). Livestock biodiversity in India: A Review, International Journal of Agriculture Extension and social development. 3 (2) pp.26-29.
11. Verma A.K. (2015). Values and Need of Biodiversity Conservation. Bioherald: An International Journal of Biodiversity and Environment. 5(1-2): 77-79.
12. Verma A.K. (2016). Biodiversity: Its Different Levels and Values. Int. Journal on Environmental Sciences. 7(2): 143-145.
13. Verma A.K. (2017a). Genetic Diversity as Buffer in Biodiversity**.** Ind Journal of Biology. 4(1): 61-63.
14. Verma A.K. (2017b). Necessity of Ecological Balance for Widespread Biodiversity. Indian Journal of Biology. 4(2): 158-160.
15. Verma A.K. (2018). Ecological Balance: An Indispensable Need for Human Survival. Journal of Experimental Zoology, India. 21 (1): 407-409.
16. Verma A.K. (2019). Sustainable Development and Environmental Ethics. International Journal on Environmental Sciences. 10(1). 1-5.
17. Verma A.K. (2021). Influence of climate change on balanced ecosystem, biodiversity and sustainable development: An overview. Int. Journal of Biological Innovations.3(2):331-337.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 102 - 109 |

Water Pollution: Consequences and Solutions with special reference to Anthropogenic approach

N.G. Shinde[1], P.P. Joshi[2], Pushyamitra Joshi[1]*

Post Graduate Department of Zoology
[1]K.J. Somaiya College of Arts, Commerce and Science, Kopargaon Dist. Ahmednagar (M.S.)
[2]Adarsh Education Society's Arts, Commerce and Science College, Hingoli (M.S.).
*Corresponding author: lokninad@gmail.com

Abstract

Water pollution is one of the biggest challenges across the globe including the countries like India. Various anthropogenic activities cause water pollution. Due to rapid increase in industrialization and urbanization, the problem becomes more and more severe in recent times. The life of human cannot be sustained without clean water. United Nations 17 sustainable goals also include access to clean water. Life of human cannot be sustained with polluted or contaminated water. Present article tries to highlight consequences and solutions with respect to anthropogenic reasons.

Keywords: Water, Groundwater, Fluoride.

Introduction

Water is viral component for the life. Water sources such as rivers, lakes, aquifers, oceans and groundwater sources such as borewells, wells, handpumps can get contaminated by a variety of anthropogenic activities. The anthropogenic activities are not only responsible for pollution but also for biodiversity threats (Prakash and Verma, 2022). Any modification to the physical, chemical, or biological characteristics of water which leads to negative effect on any living thing is referred to as water pollution. All types of wastes including electronic wastes also contribute in pollution and poor health of environment (Verma and Prakash, 2020). Drinking water which also referred as potable water is the form of water which is considered as safe for the purpose of ingestion by humans as well as by animals also. This water is typically utilised for drinking, cooking, cleaning, irrigation of crops, etc. (APEC, 2015). Nowadays, even drinking or potable water is also negatively impacted by

various means such as chemicals, bacteria and other pollutants.

Aims and Objectives

a. To discuss effects of polluted water on humans as well as environment and ecosystem.
b. To highlight wastewater technologies
c. To highlight consequences due to anthropogenic activities.

Methodology

The research work is descriptive in nature. This study is based on mainly secondary source of data. The required information collected from different government reports, research articles, journals, books, newspapers as well as internet sources. This data was then analysed and reviewed for interpretations and conclusions.

Sources of Water pollution

The widely occuring and mostly seen pollutants are as follows:

- Pesticides and insecticides
- Industrial effluents
- Domestic waste
- Fertilizers and Detergents

Generally, water pollution caused by two types of sources, that are :

- **Direct Sources**: This type of sources directly contribute to the contamination of water. The direct mode means, pollutants i.e. the substances which causing pollution directly mixed with water bodies. Factories, refineries, waste management facilities are some of the common examples of direct sources which causes pollution as the wastewater direclty pass into nearest water bodies and pollution takes place (Dwivedi, 2017).
- **Indirect sources**: In this type of sources, pollutants mixed in water water indirectly, for example; the excessive use of chemical fertilizers give rise the accumulation of chemicals in soil, these soil later on mixed up with water bodies or groundwater and the pollution takes place. The reasons behind acid rain also included in the indirect sources.

Effects of Pollution of Water

1. **Health Problems**:
   Polluted water has numerous detrimental consequences on human health, including diseases, when consumed or drunk. Typhoid, cholera, hepatitis, are some of the commonly occuring health problems caused due to polluted water.
2. **Destruction of ecosystem:** Ecosystem are vast, sensitive as well active for interactions as well as for better enviornment. A minute alretations to surrounding can negatively impacted ecosystems. If water pollution is not controlled, an entire ecological balance will be disturbed, which is harmful for biodiversity, sustainable develpment and survival of mankinds (Ashok, 2017; Verma, 2018, 2019).
3. **Eutrophication:** Chemical constituents in water bodiesleads to development of algae. On top of the pond or lake, these algae accumulate in a layer. The formed algae is consumed by bacteria which give rise to lowering of oxygen levels in

water bodies, and hence all the aquatic life present in respective water body negativly impacted.

4. **Impact on food chain:** Interuption in the food chains takes place when toxins, chemicals and pollutantswhich are present in water sources consumed by aquatic organisms such as fishes, shellfishes and later on these organisms consumed by humans. Fluoride, nitrite are some of the chemicals which may affect health of humans.

Water : General Information

The chemical formula of water is H_2O. One molecule of water made up of two hydrogen atoms covalently bonded withone oxygen atom. The earth from a space looks majorly in blue colour. This blue colour is basically water which coveres the earth. In fact water constitutes majority part of earth though its not available in usable forms. We need water almost for every activity starting from household to industrial. Human body also composed of 65% amount of water. There's no imagination of life without water on earth.

The unevenly distribution of water on earth's surface is one of issue for availability of water. Water is known as universal solvent and dissolves almost every polar solute. Water is tasteless as well as colourless liquid. Comparing to the other liquids or solutions, water shows unique properties such as thermal condutivity, dipole moment, surface tention, higher specific heat etc.

Diseases associated with water pollution

For a person to survive, they need water. The body requires water to stay hydrated as well as to support several bodily processes like digestion, metabolism, and waste removal. Yet, poor quality of the water in several parts across the globe is one of the largest issues facing humanity today. Water contamination is a major cause of numerous ailments. Sometimes it can also leads to gastrointestinal illnesses (Anderson and Stentrom, 1987). Anybody can be harmed, but children, the elderly with immune system and pregnant women are particularly vulnerable to infections from various water toxins because they have compromised immune systems (Patil, 2009; Rozina Khatun, 2017).

1. Cholera

Chlorea is known as one of the most rapidly spreading diseasecaused by the bactirium *Vibrio cholerae* the toxic strain which may enter in the body of human from water or food. The bacteria can survive even after three weeks also. Seafood is major surviving place for the *Vibrio cholerae.* Normally it takes the duration of two to four days for confirmation of the symptoms of this disease. The disease includes watery diarrhoea, nauseam cramps and vomiting. More than 50 countries across the globe reports cholera every year to world health organization. Since it is water borne disease, to overcome cholora, properly maintained hygiene, basic sanitation and clean drinking water are the basic requirements. Instant

medications should be provided throughout disease by the means of oral or intravenous for maintaining hydration.

2. Amoebiasis

Entamoeba histolytica is the parasite that causes amoebiasis. The disease is fetched on byingesting faeces from an infected person, typically through sewage or untreated drinking water. Amoebiasis causes diarrhoea, fever, and abdominal pain in addition to causing weight loss. The parasite takes two to four weeks to fully develop. In severe situations, it might weaken the abdomen and result in bowel perforations.

3. Typhoid Fever

*Salmonella typhi*is the microbiological agent that causes typhoid fever. The patient additionally has chills, cramps, and diarrhoea in addition to abdominal pain. Contaminated water is another factor in typhoid. It is a centre for illnesses. Those who have typhoid typically experience severe primary effects, and the primary infection may persist for up to three weeks or more. Flies contribute to increased food contamination. Any sort of water that has been tainted with *Salmonella typhi* can cause this illness.

4. Gastroenteritis or "Gastric Flu"

The contamination of water by calcivirus results to the gastric flu. The duration to takes infection and menifests symptoms is 36 hours. The symptoms includes fever, diarrhoea, vomitingand nausea. When people share utensils while living together, the sickness spreads quickly. As the virus may survive freezing, the ice blocks that were given for the various puproses might be contaminated. The dehydration suffered should quickly replaced in case of infants. The gastric flu not only caused by single reason of virus, there are many other causal agents also behind this that's why immunization does not aidswith respect to this disease. Drinking treated water as well as maintaining good personal hygiene is the only prevention.

5. Giardiasis

This infection caused by the parasite *Giardia lamblia*. Before exhibiting symptoms of gastrointestinal pain and increased gas, the parasite stays for 1 to 2 weeks. The infected individuals hardly exhibit any symptoms, but they could get diarrhoea and lose weight. When the excrement of a sick person or animal comes into touch with drinking water, improper sanitation causes contamination. An infected person's faeces sample is used to diagnose the condition. The condition typically affects young people more. People in good health typically recover more quickly than kids. There are readily available medications that are effective against the parasite.Clean drinking water and maintaining effective hygiene prevents the disease.

6. Hepatitis A

The hepatitis A virus pathogen is causal agent behind this disease. This disease is spread by tainted food and drink. The majority of patients get acute symptoms in lessduration. however infected patients may also experience fever,

tiredness, diarrhoea, and nausea. The main transporters are water and milk products. A preventative in and of itself is practising excellent hygiene and sanitation.

7. SARS

Coronavirus, a microbiological agent, is the cause of the severe acute respiratory syndrome, which appears in untreated water. A SARS patient typically experiences stomach issues, fever, and sore throat. It is among the most typical infections that are spread by tainted water.

8. Infection with *E. coli*

This type of infection caused by specific strains of the bacteria Escherichia coli, sometimes known as E. coli. The infected suffers symptoms including fever, vomiting,nausea and diarrhoea also.Generally one week duration takes up to shows symptoms. The loss of fluids during disease may cause severe infection to the people having weak immune system. Especiallyaged people and the childrens should follow preventive measures as the severity of this disease in them is high. Packed dairy products and juice may carriersof these causal agents.

Waste Water Treatment Processes

The process by which wastewater(the water which isnot suitable for use) converted into bilge water which can discharged back into environment known as watewater treatment processes. The formation of Waste water done by various activities such as bathing, washing and rainwater runoff etc. Waste water also comprisesof bacteria, chemicals and other toxins.

The treatment aims to reducing the contaminants upto the permissible levels and to make safe water which can be discharged back into the environment.The wastewater treatment processes divided into two types, first is known as chemical or physical treatment plant and second one known as biological wastewater treatment plant. Physical waste treatment plants generally uses chemical reactions as well as various physical activities to treat wastewater.As name itslf shows, biological wastewater treatment plant uses biological matter and various bacteria for the breaking of waste matter. Nowadays, biological treatment systems are referred asthe ideal method for treating wastewater from households and business sites. Physical wastewater treatment plants are widely used to treat the wastewater from commercial entities such as factories, industries and manufacturing firms. The reason behind this is majority amount of the wastewater from these entities contains different toxins as well as variety of chemicals which causes negative impact on the environment (Joshi and Joshi, 2020).

The general stages involves in Waste water treatment are as follows:

1. Wastewater Collection

This is the first step in waste water treatment process. The collection points are put in place by respective authority such as muncipal administration to safeguard all the wastewater collected and directed to the central point. This

water is then directed towards the site of treatment plant using undeground drainage systems or by exhauster tracks. However proper conditions should be maintained while transportation of wastewater. The pipes or tracks should be leak proof and in manual case, the people offering exhausting services should wear protective clothing. Now a days manual method is nearby closed and mechanical use is encouraged.

2. Odor Control

At the treatment plant, odor control is very important. Wastewater contains a lot of dirty substances that cause a foul smell over time. To ensure that the surrounding areas are free of the foul smell, odor treatment processes are initiated at the treatment plant. All odor sources are contained and treated using chemicals to neutralize the foul smell producing elements. It is the first wastewater treatment plant process and it's very important.

3. Screening

This is the next step in wastewater treatment process. Screening involves the removal of large objects for example nappies, cotton buds, plastics, diapers, rags, sanitary items, nappies, face wipes, broken bottles or bottle tops that in one way or another may damage the equipment. Failure to observe this step, results in constant machine and equipment problems. Specially designed equipment is used to get rid of grit that is usually washed down into the sewer lines by rainwater. The solid wastes removed from the wastewater are then transported and disposed off in landfills.

4. Primary Treatment

This process involves the separation of macrobiotic solid matter from the wastewater. Primary treatment involves pouring of wastewater into big tanks for the solid matter to settle at the surface of the tanks. The solid waste, the sludge that settles at the surface of tanks is removed by large scrappers and is pushed to the centre of cylindrical tanks and later on,driven out of tanks for further treatment. The remaining water is then undergo for secondary treatment.

5. Secondary Treatment

This is also referred as the activated sludge process. The secondary treatment stage involves addition of seed sludge to the wastewater to ensure the further breakdown. Air is pumped firstly into big aeration tank which mixes wastewater with seed sludge. Seed sludge is basically little amount of sludge which fuels the growth of bacteria which uses oxygen and growth of other mirobes consumes remaining amount of organic matter. This process leads to the production of large particles which settle down at the bottom of huge tanks. The wastewater then passes through the large tanks for the duration of 3-6 hours.

6. Bio-solids handling

The solid matter which settled out after the primary as well as secondary treatement steps are then moved towards digesters. These digesters are heated at the room temperature. The solid wastes

are undergo anaerobic digestion. During this process, the production of methane takes place and formation of nutrient rich bio solids evolved which are recyled and dewatered into the local firms. The methane formed used as source of energy at treatment plant. The methane can be used in boilers.

7. Tertiary treatment

This stage shows resemblance to the normal treatment plants of drinking water which cleans and purifies raw water for the purpose of drinking. The tertiary treatment can remove upto the 99 % of impurities from the wastewater. This produces effluent water which is closer to the quality of drinking water. Though comes up of disadvantage, this process is quite expensive as it needs special equipments and well trained as well as skilled operators etc.

8. Disinfection

Though after primary and secondary treatment stages there is possibility of causal organisms of diseases remaining in treated wastewater. To eliminate them disinfection is mandatory process. This is done with mixture of chlorine with sodium hypochlorite for the minimum duration of 20-25 minutes. The process of disinfection is an indivisible part of treatment process because it give rise to good health conditions of animals and the local people who uses water for the various purposes. The treated wastewater is then released into the environment.

9. Sludge Treatment

After the primary and secondary treatment processes, the sludge produced requires concentration and thickening to enable further processing. Normal duration of this process is 24 hours.The remaining water is then collected and sent back to big aeration tanks for the further treatment processes. The sludge is then treated and discharged back into the environment.Wastewater tretament processes comes up with number of advantages such as this ensures environment kept clean, no water pollution, making use of natural resources, preventing waterborne diseases as well as adequate amount of water for irrigation

Conclusion

From the above discussion we can conclude that, due to increase in the population, industrialization as well as domestic use,quality of the drinking water is decreased and there is a need for the proper treatment of water alongwith some prevention method to reduce water pollution. There isnecessity tomanage the safe supply of drinking water as stated in article. The awareness regarding water pollution, pollutants as well as impact on human health is important factor. At the same time, government can include environment concerns such as impact of water pollution etc.since from early education curriculum.Onlyafter theproper framework and implementation of strategies, we can say ‘Jal hi Jeevan’.

References

1. Anderson, Y. and Stentrom, T.A. (1987). Water borne outbreak in

Sweden – causes and etiology. Water, Science and Technology.19:375-380.
2. APEC (2015). The Importance of water and your health. Free drinking water.
3. Ashok, K.V. (2017). Necessity of Ecological Balance for Widespread Biodiversity. Indian Journal of Biology. 4(2): 158-160.
4. Cooke, J.G. (1994). Nutrient transformations in a natural wetland receiving sewage effluent and the implications for waste treatment. Water, Science and Technology. 29: 209-217.
5. Dwivedi, Anil K. (2017). Researches in Water Pollution: A Review. International Research Journal of Natural and Applied Sciences. 4(1): 118-142.
6. https://en.wikipedia.org/wiki/Activated_sludge
7. https://gogreenseptic.ca/what-is-wastewater-treatment-and-process-of-wastewater treatment/
8. https://www.conserve-energy-future.com/process-of-wastewater-treatment.php
9. Joshi, P.P. and Joshi, P. (2020). Textbook of Animal Ecology, Toxicology and Environmental Pollution. Shashwat Publications, Bilaspur.
10. Patil, R.B. (2009). Environment in Indian society, problems and prospects. A. Mittal publications, New Delhi (India).
11. Prakash, S. and Verma, A.K. (2022). Anthropogenic activities and Biodiversity threats. International Journal of Biological Innovations. 4(1): 94-103.
12. Rozina Khatun (2017). Water Pollution: Causes, Consequences, PreventionMethod and Role of WBPHED with Special Referencefrom Murshidabad District. International Journal of Scientific and Research Publications. 7(8): 269-277.
13. Verma, A.K. (2018). Ecological Balance: An Indispensable Need for Human Survival. Journal of Experimental Zoology, India. 21 (1): 407-409.
14. Verma, A.K. (2019). Sustainable Development and Environmental Ethics. International Journal on Environmental Sciences. 10(1). 1-5.
15. Verma, A.K. and Prakash, S. (2020). E-wastes and their impact on environment and public health. International Journal of Applied Research. 6(9): 164-168.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 110 - 117|

Water Conservation: A milestone towards sustainable future

Anuj Kumar Singh
Department of Botany, K.P.M. Govt. Girls Degree College, Aurai, Bhadohi (U.P.)
Corresponding author: anuj.aurai@gmail.com

Abstract

Water has proved role in our future perspective. It is most important source of life on Earth because we need water to fulfil all the activities of life like drinking, eating, bathing, making clothes and producing crops. For a better and sustainable future, we people should apply several strategies to save and recycle the wastage of water, a precious natural resource and also gift of our nature. Water conservation includes all the several policies, strategies and activities to sustainably manage the natural resources of fresh water, to protect the hydrosphere, and to meet the current and future human demand. Reducing water use through waterless toilets, water efficient appliances, and water quantity monitoring, is an important part of sustainability for domestic water supply. Sustainable water management means using water in a way that meets current ecological, social and economic needs without compromising the ability to meet those needs in the future.

Keywords: Sustainability, water-recycle, Natural resource, Eco-monitoring.

Introduction:

Water is transparent, tasteless, odourless and colourless chemical liquid and it is vital for all known form of life, even though it provides no calories or organic nutrients. It is definitely the most important natural resources. Nature has gifted us some precious and valuable resources. It is earth's most plentiful natural resource. Our planet, Earth, has three-fourths of its surface area covered with water and only one-fourth has land masses. Water is basic necessity of life not only for people but for all living things need water for their survival. Water is used for variety of purposes, including drinking, food preparation, Irrigation and manufacturing. Its fluidity and solubility properties make it useful in the process of digestion, blood circulation and excretion. Water also helps in regulation of our body temperature by the process of sweating (UNEP, 2011).

Amongst most of the water, 97% is found in oceans and seas. The remaining, about 3% is found in rivers, lakes, ponds, streams, etc. In our country, nearly 70% part of the available water is polluted. According to NITI Aayog report the demand of water would double than availability of it, till 2020.

The demands on this liquid fresh water on growing, and many scientists, feel that a future shortage of fresh water will use eminent water conservation and management emphasizes water quality protection, a growing area of employment and environmental concern. Water conservation and management encompasses the policies, strategies and activities made to manage water as sustainable resource, to protect the water environment and to meet current and future human demand. The more water you use, the more you pay for water and sewer service on a municipal water and sewer system.

Water security has emerged as a major burning issue towards fulfilment of sustainable development goals (SDG's) our country. In recent study water security is defined in four dimensions, each consisting of two complementary aspects: direct-indirect, macro-micro, technical-political, and peace conflict. It's essential for basic health and hygiene, and it drives society's most essential industries: agriculture, energy and transportation. Without water security there can be no national security. Infect, water is essential to the stability of every country on the planet (United Nations, 1987).

Sources of water:

Around 97% water is found in the Oceans and Seas. The remaining about 3% is found in river, lake, pond etc. Some sources of water are obvious, like lakes and rivers, while others like glaciers are a bit more removed from everyday experiences. With so many people living near water, it sometimes seems unlikely that water shortages could be a serious problem, Understanding the sources of water available for human use reveals how limited fresh water actually is despite the overwhelming amount of water on earth. Very little of it is suitable for consumption.

Water resources are natural resources of water that are potentially useful. Freshwater is a renewable resource, yet the world's supply of ground water is steadily decreasing, with depletion occurring most prominently in Asia, South America and North America, although it is still unclear how much natural renewal balances this usage, and whether Ecosystems are threatened. The framework for allocating water resources to water users (where such a framework exists) is known as Water rights (UNDESA, 2012).

Types of water sources:

There are different types of Water sources-

(1) Ground water sources:

Ground water refers to any source of water that lies beneath the soil layer. Ground water can exist in the soil itself or between rocks and other materials. Most communities obtain their water from underground aquifers, or rock formations capable of holding large amounts of fresh water. Only 3% of the water on earth is considered fresh water, with a mere 30% of that small amount being found as ground water. Pollution,

sea water contamination and over use threaten this valuable resource.

Ground water can be thought of in the same terms as Surface water, inputs, outputs, and shortage, the critical difference is that due to its slow rate of turnover. Ground water storage is generally much larger in volume compared to inputs than it is for surface water. This difference makes it easy for humans to use ground water for a long time without severe consequence. Ground water is often cheaper, more convenient and less vulnerable to pollution than surface water. Therefore, it is commonly used for public water supplies.

1. Ground water provides the largest source of usable water storage in the United States, and California annually withdraws the largest amount of ground water of all the states.
2. Underground reservoirs contain for more water than the capacity of all surface reservoirs and lakes in the U.S.

(2) Surface water:

Surface water can include any above-ground collection of water such as rivers, lakes, ponds and oceans. Some surface of surface water is also fed by underground aquifers. Surface water accounts for 80% of the water human use.

Although the only natural input to any surface water system precipitation within its water shed. The total quantity of water in that system at any given time is also dependent on many other factors. These factors include storage capacity in lakes, wetlands and artificial reservoirs the permeability of the soil beneath these storage bodies. Human activities can have a large and sometimes devastating impact on these factors. Human often increase storage capacity by constructing reservoirs and decrease it by draining wetlands.

(a) Ocean water:

Although ocean water makes up nearly 97% of all water on earth. It is not a viable source of potable water unless salt & other impurities are removed. Desalination, the process by which salt is removed from water is a rapidly growing practice, while salt and other microscopic entities can be removed from water in a variety of ways. The most promising method is through reverse osmosis. This process forces salt water through filters with microscopic pores that removed salt and other microbes. Reverse osmosis requires large amounts of energy, making it a very expensive process.

(b) Ice caps and glacial melting:

Of the 3% earths water considered fresh water, 70% of that small amount is currently locked in glaciers and ice caps. In theory, frozen glacial and ice cap water could be melted and used but the amount of energy needed to melt and transport vast quantities of ice caps also play vitally important roles in the regulation of Earth's climates and global temperatures.

Importance of water:

All plants, animals and human beings need water to stay alive, but

human beings depend on water more than plant and animals. We need water for many other purposes such as-

(a) We need water for the day-to-day activities, such as bathing, cleaning, drinking, washing etc.

(b) Water helps in the dispersal of seed and fruits. It helps needed for irrigation.

(c) All industries use a large amount of water for cleaning, heating, cooling, generating electricity, as a raw material etc.

The water in our bodies is essential for life. Without water, we can't survive. Water is involved in every bodily function from digestion and circulation through to the control of body temperature and the excretion of waste products. Water is important to the mechanics of the body. Reducing water use through waterless toilets, water efficient appliances, and water quantity monitoring, is an important part of sustainability for domestic water supply. Efficient piping systems that are leak-free and well insulated provide a network that is reliable and help to limit water waste.

Water, Sustainable development, the MDGs and the SDGs:

The Millennium Development Goals (MDGs):

The Millennium Development Goals (MDGs), agreed in 2000, aim to halve the proportion of people without sustainable access to safe and drinking water and basic sanitation between 1990 and 2015.

A total of 748 million people still do not have access to an improved drinking water source and existing indicators do not address the safety and reliability of water supplies. To reach the requirements of the right to access to safe drinking water requires real improvements for several billions of people. The MDG target for sanitation is an even more pressing challenge, with 2.5 billion people currently lacking access to improved sanitation and over one billion still practicing open defection. At current rates of progress, the sanitation target will be missed by over half a billion people. These global aggregates also mask disparities between nations and regions, rich and poor, between rural and urban populations, as well as between disadvantaged groups and the general population.

There is currently no global target to improve hygiene, despite this being one of the single most cost-effective public health interventions.

Conservation of water:

Conservation of water means a careful and economical use of water. Water conservation includes all the policies, strategies, planning movement and activities to sustainably manage the natural resources of fresh water, to protect the hydrosphere which is going to be in limited in coming days, to meet the current and future human demand (Geerts, 2009). For sustainable development this has to be managed in coming future perspective. We should conserve water as it is a precious natural

resource. It can happen in the following ways-

(a) Afforestation can help water to penetrate in to the soil and replenish the water table.
(b) Use of efficient watering systems such as drip irrigation and sprinklers to reduce water consumption by plants and helps in conservation of water.
(c) Building dams and hydropower projects which help in checking flood and regulating the supply of water to agriculture.
(d) Irrigation hours and frequency can be reduced.
(e) Treatment of industrial and domestic wastewater in sewage plants before its disposal in water bodies help in conservation of water. It reduces the water pollution.

Goals of water conservation efforts include:

(1) To ensure availability of water for future generations.
(2) Energy conservation as water pumping, waste water treatment facilities etc.
(3) Habitat conservation especially for local wildlife and migrating waterfowl etc.

Strategies:

(a) Activities regarding reduction in Run-off water losses- By using terrace farming, water spreading system, contour cultivation methods, use of some chemical like Gypsum and HPAN (Hydrolysed Polyacrylonitrile) and improved water storage system.
(b) Avoiding any damage to water quality by using different techniques.
(c) Improving water management practices like Rain water harvesting system, Afforestation, Agroforestry and water shed management system

Rain water harvesting:

It is the accumulation and storage of rain water for reuse on-site, rather than allowing it to run-off. Rain water can be collected from rivers or roofs and in many places, the water collected is redirected to a deep it like well, shaft, (or) bore hole, a reservoir with percolation or collected from dew or fog with net or other tools. Harvested water can also be used as garden water, for live stocks for irrigation, for other domestic uses and also as drinking purposes.

It is one of the simplest and oldest methods of self-supply of water for households usually financed by the user. History of rain water harvesting is quite traced back to the Neolithic age where 'Cisters' are used to store rain water where 'lime plaster cisters' were built in the floors of houses in village. By the late 400 BC, cisters were essential elements of emerging water management strategies and planning used in "dry-land farming". Rain water harvesting was famous and concurrent during ancient times in many of western countries like Jerusalem, Israel, Balochistan etc. In India, 'Kutch' is famous for its rain water harvesting planning in form of

'Cisterns'. 'Chola kings' were also involved in rain water harvesting techniques for water conservation purposes. It was also common in "Roman Empire" in form of 'Roman cisterns'. 'Brasilea cistern' is also common in Byzantine Empire. The town of Venice depended on rain water harvesting. The ancient inhabitants of Venice established a system of rain water collection. Water percolated down the specially designed stone flooring and was filtered by a layer of sand, then collected at the bottom of the well. They are especially important in time of war when access the main land water could be blocked by an enemy.

In Canada, they have also started implementing rain water harvesting systems for use in storm water reduction, irrigation, laundry and lavatory plumbing.

In India, Tamilnadu state was the first to make rain water harvesting compulsory for every building to avoid ground water depletion. The scheme was successfully launched in year 2001, and has been implemented in all rural areas of Tamilnadu. It gave excellent and wide results within five years and slowly every state took it as a role model. "Chennai" has a 50% rise in water level in five years in Karnataka, Bengaluru, adoption of rain water harvesting is mandatory for every owner or the occupier of a building having the site area measuring 60 ft (18.3m) x40 ft. (12.2) and above and for newly constructed building measuring 30 ft (9.1m) x40 ft. (12.2) and above dimensions. In this regard, Bangalore water supply and sewerage Board has initiated and constructed 'Rain water Harvesting Theme Park' in the name of Sir M. Visvesvaraya in 1.2 acres (4900 square meter) of land situated at Jayanagar, Bangalore. In different states like Rajasthan (Thar Desert) Chauka system in Jaipur district is exercised. Maharashtra (Pune) rain water harvesting is considered as a good solution to solve the water crisis and also it is very compulsory for any new housing society to be registered.

In foreign countries "Israel" the first rain water catchment system was installed at an elementary school in Lod, Israel. In New Zealand, Srilanka (Lanka rain water harvesting forum), South Africa (South African Water Research Commission) reports are available on their "Knowledge Hub" "Hydro fracturing" has been regularly used to improve the performance of water bore holes. In United Kingdom "Water butts" are often found in domestic gardens to collect rain water. In other countries like China, Argentina, Brazil "Roof top rain water harvesting" is being practiced for providing drinking water, domestic water, water from livestock, "Gansu" province in China and semiarid 'north east Brazil' have the largest roof top rain water harvesting projects going on. 'Thailand' has the largest fraction of population in the rural area relying on rain water harvesting.

Importance of Water conservation and Sustainability:

Fresh, clean water is a limited resource. While most of the planet is covered in

water, it is salt water that can only by consumed by and other species after undergoing desalination, which is an expensive process (Biswas, 1998). Occurrences such as droughts further limit access to clean and fresh water. In some areas of the world, access to water is limited due to contamination. People who have access to fresh water can take effective steps to limit their use of water to avoid wastage.

People should do their best to conserve water for three reasons. The less water used or wasted by people; the less clean water will become contaminated. In some cases, using excess amounts of water puts strain on septic and sewage systems.

Water is at core of sustainable development and is critical for socio-economic development, healthy ecosystems and for human survival itself. Water conservation ultimately reduces much of the energy use and can even save households many things

Conclusion:

Earth has a finite amount of fresh usable water. Fortunately, water is naturally recycled; humans have developed various technologies to speed the process. Conservation of water can ensure that supplies of fresh water will be available for everyone, today and tomorrow's daily life. Water conservation involves changing habits. People able to take some more advanced steps to reduce water consumption and move one step forward towards sustainable life. An individual may simply use less water. People can shorten their shower time or reduce the amount of water they use when bathing. Other conservation methods initially require more effort and funds but the reduction in over anthropogenic activities, eco-friendly sustainable development can be achieved (Ashok, 2019; Prakash and Verma, 2022), however climate change also influences every aspects of human life (Verma, 2021).

The increasing decline in the level of ground water, in many parts of the country, is leading to a lot of in sustainability. Lack of proper waste water treatment from industrial, mining and domestic sources is causing a potential threat to humans as well as the ecological balance. The ecological balance is needed for rich biodiversity and survival of entire biota including humans (Ashok, 2017; Verma, 2018). Water is crucial resources for the country today. Due to the growing population, increasing industrialisation and escalating agricultural scenario, the demand for water has clearly increased over the years. Thus water conservation is essentially and evidently the need of the hour is that every individual uses water economically and judiciously for sustainable future. Although still several efforts are being made at Governmental and inter-governmental level by building dams, wells and reservoirs, there is still a long way to go. We have to motivate our living communities to adopt different water conservation practices, such as Rain water harvesting system, Water shed management practices and many more other conventional practices to

save more water in our daily routine life and also make a remarkable step or we can say that certainly it can proved to be a milestone towards a Sustainable future**.**

References:

1. Ashok, K.V. (2017). Necessity of Ecological Balance for Widespread Biodiversity. Indian Journal of Biology. 4(2): 158-160.
2. Ashok, K.V. (2019). Sustainable Development and Environmental Ethics. International Journal on Environmental Sciences. 10(1). 1-5.
3. Biswas Aset K. (1998). Water Resources, Tata McGraw-Hill Publishing Company, New Delhi.
4. Geerts, S., Raes, D. (2009). Deficit irrigation as an on-farm strategy to maximize crop water productivity in dry areas. Agric. water manage. 96(9):1275-1284.
5. Prakash, S. and Verma, A.K. (2022). Anthropogenic activities and Biodiversity threats. International Journal of Biological Innovations. 4(1): 94-103
6. UNDESA (2012). Sustainable Development for the 21st Century Back to our Common Future. UNDESA.
7. UNEP (2011). Towards a green Economy Pathways to sustainable development and poverty eradication, www.unep.org/greeneconomy
8. United Nations (1987). Our Common Future, Report of the World Commission on Environment and Development.
9. Verma A.K. (2018). Ecological Balance: An Indispensable Need for Human Survival. Journal of Experimental Zoology, India. 21 (1): 407-409.
10. Verma, A.K. (2021). Influence of climate change on balanced ecosystem, biodiversity and sustainable development: An overview. International Journal of Biological Innovations. 3(2):331-337.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 118 - 121|

Weather conditions affect animal behaviour

Rachana Singh
Department of Zoology, Dayanand Girls P.G. College, Kanpur (U.P.)
Corresponding author: rachanasingh12jan@gmail.com

Abstract

Climate change is expected to exert an overwhelming negative effect on livestock, health and welfare. The negative effects of climate change on animal health and behaviour will be the consequence of combined changes of air temperature, frequency and magnitude of extreme weather events and may be both direct and indirect. Animals respond to physical, chemical, climatic and biological stimuli from their surroundings. Animals are sometimes exposed to inclement weather. A combination of low temperature, wind and rain or wet snow can adversely affect an animal's heat balance. Climate change in expected to impact most parts of an ecosystem. Some animals have very specific climatic adaptation such as requirements for snow, sea ice, or temperatures within a narrow range for hibernation.

Keywords: Temperature, Climate, Animal, Behaviour.

Introduction:

Different animals react differently to different weather conditions. However, in general, weather conditions can affect animal behavior in a number of ways. For example, weather conditions can affect the availability of food and water, which can in turn affect the behavior of animals that rely on these resources. Additionally, weather conditions can affect the ability of animals to find shelter, which can lead to animals being more or less active depending on the weather.

The six common types of weather create all weather conditions. With the right humidity wind, atmospheric pressure, temperature, clouds and precipitation, a rainstorm happens. On Earth, the common weather phenomena include wind, cloud, rain, snow, fog and dust storms. Less common events include natural disasters such as tornadoes, hurricanes, typhoons, and ice storms. Weather is made up of multiple parameters, including air temperature, atmospheric pressure, humidity, precipitation, solar radiation and wind.

Most terms trial animals do seek shelter.... Rain seems to annoy most species; however, even aquatic animals. Some animals hibernate, or sleep, while other animals go to warmer areas in the winter. When animal goes to a warmer place it is called migration. Finally other animals adapt to survive in the snow and cold temperature. Climate is expected to exert an over whelming negative effect

on the health of animals (Robinowitz and Conti, 2013) and change in it cause adverse effect on biodiversity (Verma, 2021). The direct effect of climate change on health may be due to increased temperature and intensity of heat waves (Gaughan et al., 2009). To understanding how animals respond to weather conditions is a fundamental topic in evolution, ecology, and conservation, especially in a time of major environmental change. Birds are an ideal group in which to investigate these relationships because they occur in almost every ecosystem across the globe. In recent time, research examining the effect of weather on birds has focused predominantly on the impact of climate change (Crick, 2004; Dunn and Winklex, 2010; Sekercioglu et al., 2012; Riddell et al., 2021). Short-term or localized changes in temperature, rainfall and wind can strongly influence individual behaviour, life history, physiology and morphology, with consequences at the population and species levels.

How does cold affect animal behaviour?

In general, cold weather can have a number of effects on animal behaviour. For example, cold weather can make it more difficult for animals to find food and water, which can lead to them being less active. Additionally, cold weather can make it more difficult for animals to find shelter, which can lead to them being more susceptible. Animal and birds must act differently during the winter to survive. People stay inside, wear warm clothes, turn on heat and eat warm food. On other hand animals hibernate or sleep while other animals go to warmer areas in the winter. Animals travel to other places where the winter is warmer and they can find food to eat. According to Cermen Willings Some bird, but not all, migrate south. Some animal hibernate for part or all of the winter animal hibernate to save their energy and don't need to eat. They store food as body fat and use this fat as energy during hibernation. Some squirrels and mice hibernate. Bears are happens as they wake up to move around little but not to eat.

But on other hand many animals remain and stay active in the winter and adapt to the changing weather. The animals make changes in their behaviour or bodies. To keep warm, they may grow thicker fur. Animal mostly breed during late winters or you can say in spring season or summer. In very cold areas, animals wait until summer, when the ice begins to melt, to migrate, mate and forage for food.

How does summer affect animal behaviour?

Animals in the summer period have the peak of their activity. They go hunting, reproduce and in this time of the year they start to store energy, that will be really necessary for them in the winter and autumn time. Animals also find ways in the summer to locate and conserve water and avoid being active during the hottest parts of the day. Small organism like bacteria and viruses, increase their growth, creating a greater chance for the spread of disease. In dry

areas, summer heat can be very dangerous and many animals seek protection underground and venture out mostly at night cold blooded animals like Lizards and snakes must warm themselves in the sun's rays.

Animals especially change their patterns and behaviors based on the cycle of seasons. Many animals breed so that they give birth in the spring and raise their young in the summer, when food is plentiful. Heat stress can contribute to the occurrence of lameness in dairy and beef cows (Shearer, 1999). The contribution of heat stress to lameness is perhaps due to increased output of bicarbonate (Cook and Nordland, 2009).

How does weather affect animal health?

Weather conditions can also cause diseases or trigger epidemics among animals. Many animals get weaker during the winter due to harsh weather, which makes them more susceptible to becoming sick.

The direct effects of climate change on health include temperature -
related illness and death. Whereas indirect effects include those derived
from the influence of climate on microbial density and distribution, food
and water shortages, or food borne diseases.

Some diseases like Ketosis and liver lipidosis are very common in animal. Ketosis is metabolic diseases that occur when animal is in a severe state of negative energy balance and accumulates ketone bodies which derive from incomplete catabolism of fat (Lacetera et al., 1996; Basirico et al., 2009). Heat stress may impair the function of the immune system in food-producing animals (Lactera, 2012). A series of studies have described a greater risk of mortality during the hottest months (Dechow and Goodling 2008; Vitali et al., 2009).

It was also reported that during the severe and prolonged heat waves in Europe (2003), thousands of pigs, poultry and rabbits died (Vitali et al., 2015). Climate is one of many factors which is expected to exert an overwhelming negative effect on health of humans and animals (Robinowitz and Conti, 2013).

Conclusion:

Human-induced climate change and anthropogenic activities have contributed to changing pattern of extreme weather across the globe including distribution and behavior of plant and animals (Prakash and Verma, 2022). From a broad perspective, all weather events are now
connected to climate change. While our understanding of how climate change affects extreme weather is still developing, evidence suggests that extreme weather may be affected even more than anticipated.

We can protect animals by eating less animal meat, especially red meat; will decrease our reliance on animal-based products that drastically harm the environment. There are several things we can do to protect the climate.

- Use less energy most greenhouse gases are emitted by power plants, industry and traffic.
- Produce clean energy
- Recycle more and create less trash
- Reduce water waste

References:

1. Crick, H.Q.P. (2004). The impact of climate change on birds. Ibis 146, 48-556.
2. Dechow, C.D. and R.C. Goodling, 2008. Mortality, culling by sixty days in milk, and production profiles in high and low Survival Pennsylvania herds. J. Dairy Sci. 91: 4630-4639.
3. Dunn, P.O., and Winkler, D.W. (2010). "Effect of climate change on timing of breeding and reproductive success in birds" in Effects of climate change on Birds, eds. A.P. Moller, W. Fieldler, and P. Berthold (Oxford: Oxford University Press), 113-128.
4. Gaughan, J.B., N. Lacetera; S.E. Valtorta, H.N. Khalifa, G.L. Hahn, and T.L. Mader, 2009. Response of domestic animals to climate challenge In: Ebi, K.L., I. Burton and G.R. McGregor, editors, Biometeorology for adaptation to climate variability and change Heidelberg (Germany) : Springer Verlag; p. 131-170.
5. Lacetera, N. 2012. Effect of environment on immune functions. In: Collier, R.J. and J.L. Collier, editors; Environmental physiology of livestock. Chichester (England): Wiley - Blackwell; P. 165-179.
6. Lacetera, N.U. Bernabucci, B. Ronchi and A. Nardo, 1996. Body condition score, metabolic status and milk production of early lactating dairy cows exposed to warm environment. Riv. Agric, Subtrop Trop. 90 : 43-55.
7. Prakash, S. and Verma, A.K. (2022). Anthropogenic activities and Biodiversity threats. International Journal of Biological Innovations. 4(1): 94-103.
8. Rabinowitz, P., and L. Conti., 2013. Links among human health, animal health, and ecosystem health. Annu. Rev. Public Health 34 : 189-204.
9. Sekercioglu, C.H., Primack, R.B., and Wormwarth, J. (2012). The effects of climate change on tropical birds. Biol. cons. 148, 1-18.
10. Shearer, J.K. 1999. Foot health from a veterinarian's perspective. Proc. Feed. Nutr. Manag. Cow. Coll. Virg. Tech. 33-43.
11. Verma, A.K. (2021). Influence of climate change on balanced ecosystem, biodiversity and sustainable development: An overview. International Journal of Biological Innovations. 3(2):331-337.
12. Vitali, A., U. Bernabucci, A. Nardone, and N. Laceter, 2009. Effect of season, month and temperature humidity on the occurance of clinical mastitis in dairy heifers. Adv. Anim. Biosci. 7: 250-252.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 122 - 133|

Emerging challenges of environmental issues

Ranjit Shaw, Subhashree Priyadarsini, Srabaita Roy and Radha Chaube*
Institute of Science, Banaras Hindu University, Varanasi (U.P.)
*Corresponding author: chauberadha@rediffmail.com

Abstract

Natural sources of pollution, such as volcanoes and forest fires, have existed since the dawn of civilization and are unavoidable. The expanding population and new inventions to meet the population's demands have resulted in a polluted Earth. This chapter summarises the primary emerging pollutants that are important to the population, such as pharmaceuticals, agriculture, microplastics, nanoparticles, endocrine disrupting substances, hormones, phthalates, personal care items, and so on. The chapter addresses the sources that have already been proposed, their fate in the environment, and their estimated and studied negative consequences on the environment, human health, and ecosystem biodiversity. The challenges that must be addressed to obtain a clear picture of the contaminants have also been covered. In the past, the world has worked together to address the problem of pollution and devised means to manage it and safeguard the environment. Because the population shares the same atmosphere, lithosphere, and hydrosphere, pollution is a global issue with no borders or boundaries. As a result, studies into the various origins of these pollutants, their fate in the ecosystem, and their impact require a worldwide perspective. Studies in this sector might aid us in combating these issues when they arise.

Keywords: Emerging pollutants, pharmaceuticals, antibiotic resistance, nanoparticles, microplastics.

Introduction

Humans rely on the environment to survive. The physical, chemical, and biological properties of an environment are made up of its components. The environment is under pressure because of the rising population. The depletion of natural resources and biodiversity, the generation of trash, and the destruction of natural habitats are all important issues that must be addressed if life on Earth is to be sustained for the next century (Mittal, 2013). The demands of the ever-increasing population have resulted in innovations and transformations in human society. Pesticides and gene modifications were used to boost output to feed and support the growing population. Nanoparticles are found in sunscreen, deodorants, and cosmetics. Textile waste has become a concern as a result of the easy availability of trendy and less expensive clothing. Furthermore, modern society is

confronted with the fastest-growing proportion of e-waste that shows bad effect on environment (Verma and Prakash, 2020). Additionally, agriculture contributes as an emerging pollutant in modern times.

Our environment

Our environment is made up of four interconnected elements. The atmosphere, lithosphere, hydrosphere, and biosphere are the four components. The atmosphere is the gaseous mixture that surrounds us and allows us to live. It's mostly made of oxygen and nitrogen. The hydrosphere is made up of all of the water on the planet and is interconnected. The lithosphere is the Earth's surface that we live on. The oceanic and continental lithospheres are the two forms of the lithosphere on Earth. The biosphere refers to all life forms on the Earth.

Pollutants and their impact on environment

Pollutants wreak havoc on the physical and chemical properties of the substances in which they are found. The traditional concept of pollution includes air, water, and land pollution. Noise pollution, light pollution and plastic pollution are all examples of modern-day pollution brought on by society's recent modernisation. Pollution is a negative occurrence that affects all biotic and abiotic components of the ecosystem. Pollutants are interrelated in the same way that the components of our environment are. Because contaminants are diverse and dispersed across the ecosystem, it is a major concern. Pollutants in the soil are carried into bodies of water through runoff. This pollutes the surface and groundwater (Bell *et al.*, 2011)

Emerging pollutants (EPs) are natural or man-made substances that are not normally tracked in the environment but have the potential to enter the environment and have known ecological and/or human health consequences. The EPs include a wide range of synthetic chemicals found in water, such as food additives, hormones, detergents, surfactants, flame retardants, pesticides, cosmetics, personal and household care products, pharmaceuticals, and other organic compounds produced primarily by human activity and used all over the world.

Chemical micropollutants are frequently formed when organic substances break down, leading to the accumulation of persistent metabolites. Disposal of products like pharmaceuticals in the natural environment also leads to the accumulation of these micropollutants in the environment. Since these chemicals are used in pharmaceuticals, personal care products. It is critical to assess their eco-toxicological effects for analysis and removal from the environment.

Pharmaceuticals as emerging pollutants

Chemicals like pharmaceuticals are found more concentrated in the wastewater discharged from hospitals, care facilities, and other medical facilities. Chemical micropollutants in low concentrations remain undetected and are easily reused after treatment,

posing problems for the environment as well as humans.

Pharmaceutically active compounds are complex molecules with different functionalities and physio-chemical and biological properties. The chemical nature of these chemicals can be altered metabolically and through processes like biotransformation, biodegradation, and other non-biotic transformations such as photo-transformation and hydrolysis. Such processes generally lead to decreased toxicity. However, these may lead to more active compounds. Left-out and outdated medicines from households are discarded as waste ends up in landfills and enters the environment. 76.5 % of unused medicines are thrown away, while 11.2% are flushed down the drain (Kummerer, 2009).

Pharmaceuticals and the emerging problem of antibiotic resistance

The use of pharmaceuticals is inevitable, as is avoiding their environmental impact.These medications can be transmitted into the aquatic environment, where they will infiltrate the aquatic ecosystem and have a wide range of effects.Veterinary drugs are eventually discharged into the environment. Dilution with water balances high concentrations of therapeutic medicines in medical effluents, only adds to the problem of water scarcity.

The bacteria in the environment that were originally sensitive have become resistant as a result of continued exposure to low concentrations of these medications (Phoon *et al*., 2020). The environment's resistant microorganisms find their way into the human body. Antimicrobial medications, to which these resistant microorganisms in the human body were formerly sensitive, are no longer effective against them.

Impact of antibiotics on environment

Antibiotics can operate as signalling agents in the microbial environment, as well as induce antibiotic resistance in low quantities over time. According to studies, these compounds have been found to alter chloroplast replication, transcription and translation processes, folate biosynthesis, fatty acid synthesis, and sterol biosynthesis pathways. The effect of these medications on cyanobacteria and green algae is a major problem associated with their discharge (Chen *et al*., 2020).

Impact of antibiotics on human health

Antibiotics have been used inappropriately and indiscriminately in ecosystems, resulting in the development of bacterial resistance (Phoon *et al*., 2020). These medications are metabolized in animals and discharged as waste into the environment. These are employed as manures to promote soil fertility (lithosphere), which allows these toxins to reach the ecosystem. Antimicrobics in the soil from both animals and humans are now contaminating the earth.

Steroid pharmaceuticals as emerging pollutants

Steroid hormones are vital elements synthesized naturally in humans, plants, and animals. They regulate osmoregulation, sexual maturity, reproduction, and stress responses,

among many other physiological functions. The need of the hour is for research on the main sources of steroid hormones in the aquatic environment, their current influence in complicated mixes, their fate in the environment, and their impact on aquatic life. It is critical to examine the eco-toxicological information on these widely dispersed substances to address their impact on the ecosystem (Ojoghoro *et al*., 2021). It is hard to determine the compounds of concern and their impact on the environment without a thorough understanding of these chemicals.

According to studies, synthetic progesterone poses a greater danger to the aquatic ecosystem than natural progesterone. Furthermore, studies and research into the effects of steroid combinations have paved the way for a better understanding of the mechanism of action (Ojoghoro *et al*., 2021).

Endocrine disrupting compounds (EDCs) as emerging pollutant

The U.S. Environmental Protection Agency (EPA) defines EDCs as "an exogenous agent that interferes with the synthesis, secretion, transport, metabolism, binding action, or elimination of natural blood-borne hormones that are present in the body and are responsible for homeostasis, reproduction, and the developmental process." EDCs are highly heterogeneous chemicals that include synthetic chemicals such as industrial solvents or lubricants, as well as their by-products, plastics [bisphenol A (BPA), plasticizers (phthalates), pesticides, fungicides (vinclozolin), and pharmaceutical agents (DES) (Diamanti-Kandarakis *et al*., 2009). These compounds are bio-accumulative in adipose tissue due to their low water solubility and extremely high lipid solubility. Because of the same features and similarities of the receptors, there is no endocrine system that is resistant to these compounds, which is a source of concern. Studies have been conducted on the role of EDCs in diseases such as obesity, diabetes, and cardiovascular disease (Diamanti-Kandarakis *et al*., 2009). These compounds are proposed to affect female reproductive development; fertility and the initiation of menopause. Humans are contacted with these compounds through drinking water containing these pollutants.

Nanoparticles as emerging pollutants

A nanoparticle (NP) is a tiny particle with a diameter of 1 to 100 nanometres. Nanoparticles can be found in coatings, paints, pigments, catalytic additives, and cosmetics (Bundschuh *et al*., 2018). Biomedical nanoparticles have a variety of biomedical uses, including biological labelling, medications and gene delivery, tissue engineering, and so on. According to the study, landfills and soils account for the majority of worldwide NP emissions, followed by emissions into the aquatic environment and the air.

According to studies in this sector, NPs can harm biota by causing the development of reactive oxygen species (ROS) that impair biological structures. As a result, NP causes oxidative stress in biological systems (Bundschuh *et al*.,

2018). Small particles comprising elements such as uranium, iron, lead, zinc, silicon, titanium, sulphur, coal, platinum, chromium, vanadium, manganese, mercury, and others found in mining effluent and dust can pose an unseen health danger to humans. Uranium-containing NPs (also known as U-NPs) are biologically active. They are not only chemically poisonous but also radioactive, which exacerbates the contamination (Silva *et al*., 2021). These particles have a high chance of accumulating inside the human body.

The uranium that the human body absorbs is normally filtered by the kidneys and excreted in urine. According to studies, kidney damage, bone poisoning, hepatotoxicity, neurotoxicity, impaired osteogenesis, and reproductive abnormalities are just a few of the serious impacts of these particles on the human body.

Personal care products as emerging pollutants

Personal care products (PCPs) are a broad category of chemicals that we utilise in our daily lives. Disinfectants (such as triclosan), fragrances (such as musks), insect repellents (such as DEET), preservatives (such as parabens), and UV filters (e.g., methyl benzylidene camphor) are among them. While pharmaceuticals are meant for internal use, PCPs are products produced for external use in the human body. As a result, they are not susceptible to metabolic changes and reach the environment unchanged. According to research, these compounds are persistent in the environment, bioactive, and have the potential for bioaccumulation (Brausch and Rand, 2011).

Disinfectants

Triclosan (TCS) and Triclocarban (TCC) are antimicrobial biphenyl ethers found in soaps, creams, deodorants, and plastics. TCS and TCC are two organic waste chemicals that are regularly encountered. In several investigations in Switzerland, TCS and its derivatives [methyl triclosan (M-TCS)] have been found in WWTP effluent, surface water, and even fish tissue in many investigations (Halden and Paull, 2005). Other regularly used disinfectants, such as phenol, 4-methyl phenol, and biphenylol, have the potential to pollute aquatic ecosystems. TCS and biphenylol toxicity have been investigated in invertebrates, fish, amphibians, algae, and plants.

Fragrances

Fragrances are a common type of PCP that is believed to be widespread as pollutants in the environment. Synthetic musk is a popular aroma that can be found in deodorants, soaps, and detergents. Synthetic musks are present as pollutants ubiquitously (Sumner *et al*., 2010). Nitro musks (developed in the late 1800s) and polycyclic musks (introduced in the 1950s) are two types of synthetic musks. According to studies, polycyclic musks are more acutely hazardous than nitro musk. These compounds are strongly bio-accumulated in aquatic organisms because they are

water-soluble and have high octanol-water coefficients.

Insect repellents

The most common active ingredient in insect repellents is N, N-diethyl-m-toluamide (DEET). It was developed in the 1940s. It works by preventing insects from detecting lactic acid in their hosts. DEET has been found in WWTP effluent and surface water all over the world. Because of its low bioconcentration factor (BCF), DEET, unlike other PCPs (fragrances and UV filters), is unlikely to be bioaccumulated (Brausch and Rand, 2011). It persists as a soluble form in the aquatic environment.

Preservatives

Preservatives refer to parabens (alkyl-p-hydroxybenzoates), which are anti-microbial in action. There are seven different forms of parabens in use: benzyl, butyl, ethyl, isobutyl, isopropyl, methyl, and propyl. Benzyl paraben appears to be the most hazardous of the seven commonly used parabens. Methyl and propylparaben are the most widely used to boost preservation effects in cosmetics.

Ultraviolet (UV) filters

The increased use of UV filters is due to the ever-increasing worry about the effects of ultraviolet (UV) radiation on people. UV filters are used in sunscreens and cosmetics to protect against UV rays. Organic (absorb UV light, e.g., methyl benzylidene camphor) or inorganic (reflect UV radiation, e.g., ZnO, TiO2) micro-pigments can be used. UV filters with high lipophilicity and environmental stability are observed in aquatic creatures' tissues. According to a study, UV filters have a harmful effect after prolonged exposure. They're also said to have estrogenic properties (Brausch and Rand, 2011). The impact of these items on benthic communities must still be investigated. Benthic communities are an essential part of the aquatic ecosystem and are targets for PCPs due to their chemical properties, although they are yet to be explored.

Microplastics as emerging pollutants and marine pollution

While larger plastics are disposed of in landfills due to rigorous regulations, there are still plastics beneath the soil layer that can be hazardous. Aside from the plastics in landfills, the microplastics that end up in the environment are becoming a more serious environmental hazard. Since their discovery in the 1970s, microplastics have been reported to be prevalent everywhere in the marine environment, from the Arctic to the Antarctic. More than 5,300 synthetic polymer grades are referred to as "microplastics." These synthetic polymers, which were originally developed to assist in solving human issues, have now become contaminants. Plastics that are thrown away after use, and end up in landfills, are a major source of soil pollution. Plastic breakdown products (microplastics) have recently been reported as a pollutant in the marine environment (Cauwenberghe *et al*., 2013). Microplastics employed as washing and exfoliating agents in

personal care items such as shower gels, toothpaste, nail polishes, eye shadows, and so on end up in the environment since they cannot be filtered by WWTPs. Textile washing releases micro threads into the wastewater. Plastic films are used in agriculture to preserve moisture, minimize irrigation, fertilizer costs, weed growth, and raise soil temperature, resulting in increased soil fertility and crop yield. With time, these plastic sheets deteriorate, shatter, and are discharged into the environment (Qi *et al*., 2020). There is a trophic transfer of micropollutants into humans when these fish are ingested by humans. Microplastics are present everywhere in the environment and can enter the human body and can cause chromosomal alterations which leads to infertility, obesity, and other diseases in fishes and humans (Sharma and Chatterjee, 2017; Verma and Prakash, 2022). Marine pollution has been identified as an emerging pollutant in numerous articles in the past.

Fashion and its trend as an emerging pollution

After the aviation industry, the fashion industry is the second greatest industrial polluter, accounting for up to 10% of global pollution. Water usage, chemical pollution, CO2 emissions, and textile waste are the key issues facing the fashion sector as an emerging polluter. These textile industries are estimated to use over 1.5 trillion litres of water per year and produce over 92 million tonnes of trash (Niinimaki *et al*., 2020).

Fast fashion and its impact

According to studies, one ton of cloth requires 200 tons of water to manufacture. Water is primarily used in the fashion industry for cotton cultivation and wet textile manufacturing processes such as bleaching, dyeing, printing, and finishing. Cotton, more than any other fiber, has the biggest water footprint (Niinimäki *et al*., 2020). Aside from the excessive water usage in the manufacture of fiber, the problem of water pollution caused by manufacturing plants is significant. Manufacturing plants release hazardous, poisonous chemicals into bodies of water, damaging the environment (figure 8). These poisonous substances can subsequently make their way into the food chain via commercial fish, humans, and other species.

The textile industry contributes to carbon emissions as well. According to the Intergovernmental Panel on Climate Change, the textile industry contributes 10% of worldwide greenhouse gas emissions (Niinimaki *et al*., 2020). Initial fiber extraction uses the most energy and emits the most CO2, especially for synthetic fibres like acrylics, which are made from fossil fuels. The usage of heavy agrochemicals causes a variety of ailments such as nausea, diarrhoea, cancer, and respiratory diseases. These substances have the potential to cause neurological and reproductive issues. Infertility, miscarriage, and birth abnormalities are all possible side effects.

Agriculture and its role as an emerging pollutant

Chemicals were developed to protect crops and reduce damage in the fields to achieve high yields and meet the needs of a growing population. These compounds not only protect plants from harm but also assist farmers in achieving their target yield from their crop areas. Pesticide use has risen steadily over the last decade. As a result, pesticides have been discovered in various parts of the ecosystem. There have been reports that pesticides are detrimental to humans, the environment, and other living species. Inhalation (nose), ingestion (mouth), and penetration (skin) are the most common methods for these hazardous substances to enter the human body. Even though these compounds are broken down and eliminated from the human body, a small fraction of them will remain in the blood. Pesticide concentrations that stay in the human body can cause toxicity, and exceeding a particular value can result in death. Pesticide poisoning is more likely among infants, children under the age of ten, pesticide applicators, and farm laborers (Boudh and Singh, 2019).

Effect of pesticides on humans

The acute effects of pesticide exposure do not always necessitate immediate medical attention and can include symptoms such as skin itching, nose and throat irritation, headache, rash and blisters on the skin, nausea, vomiting, stinging of the eyes and skin, diarrhoea, dizziness, blindness, blurred vision, and rarely death. These substances harm the liver, lungs, and kidneys. This can lead to a variety of neurological issues, including memory and coordination problems, as well as impaired visual and motor signalling abilities. It can also be carcinogenic as well as mutagenic.

Effect of pesticides on environment

It is obvious that any contaminant in one section of the ecosystem eventually spreads to other parts of the environment and has an impact on them. Other animals and insects that aren't targeted can consume the pesticides that are applied to the fields. Pesticides can also be used to target plants. Pesticides that end up in the soil have an impact on the soil biota. These toxins build up in the water and are ingested by animals such as commercial fish and other creatures. This causes water toxicity and aquatic life toxicity. These hazardous substances wind up in human bodies when these animals are consumed by people. To summarize, chemicals created to manage pests and increase output for an ever-increasing population end up being bioaccumulated in humans.

The application of contaminants such as pesticides, polycyclic aromatic hydrocarbons (PAHs), chlorophenols, petroleum, and similar chemicals degrades the lithosphere, which supports life (Boudh and Singh, 2019). According to studies, pesticide-converted products have been found in the soil and water and harmful to aquatic animals such as fishes (Prakash and Verma, 2014, 2020, 2021).

Effect of pesticides on biodiversity

Pesticide usage and presence in aquatic ecosystems clearly have a significant impact on aquatic biodiversity. These pesticides have been reported to impact animal development and reproduction. Carbaryl and the herbicide glyphosate have been demonstrated to be hazardous to amphibians (Boudh and Singh, 2019). Reports have stated that the usage of the pesticide neonicotinoids is to blame for the declining population of bees. Honeybee populations have decreased by 29 to 36 percent (Boudh and Singh, 2019). Bees not only aid in pollination and fruiting, but they are also undeniably important members of ecosystems. Pesticides ingested by birds can induce nervous system damage, behavioural abnormalities, and even death. The over use of pesticides and anthropogenic activities pollute the environment that disturbs the ecological balance and creating a problem for biodiversity (Verma, 2017; Prakash and Verma, 2022).

Agriculture and air pollution

Agricultural activities release nitrogen-containing chemicals into the atmosphere, such as NO_2, NO, NH_3, and N_2O. According to reports, agriculture is the principal source of NH3 and N2O (Aneja *et al*., 2009); Sutton, 2018). Agriculture is the major producer of N_2O into the atmosphere (Paustian *et al*., 2004). Agriculture and animals also contribute to the release of methane and non-methane volatile compounds (VOC). Agricultural areas release insecticides and fungicides that are used on crops. Agriculture is thought to be the primary source of anthropogenic ammonia in the environment. Livestock, mineral fertilizers, biomass combustion, and crop leftovers all emit ammonia (Aneja *et al*., 2009). The use of fertilisers has resulted in greenhouse gases emission.

Electronic waste as an emerging pollutant

Electronic gadgets or equipment that is no longer useful is referred to as electronic waste (e-waste). With technological advancements, the demand for electronic gadgets has skyrocketed. The world has seen a rise in demand for electronic devices as a result of the pandemic (Yu *et al*., 2020). Every person now owns a mobile phone which is an electronic device. Without a doubt, the internet has made our lives easier. It has had a significant impact on the way we learn, interact, and transact in a relatively short period, but it has also created concerns about the management of e-waste. When these wastes end up in the ecosystem, they represent a risk to both the environment and the inhabitants.

Impact on environment

E-waste that is disposed of directly into the environment pollutes the air by generating dust particles and poisons like dioxins. Burning e-waste releases particles that can travel long distances, endangering human and animal health. When operations for extracting metals from e-waste are not carried out properly, hazardous chemicals are released into the environment (Perkins *et*

al., 2014). The toxins released into the air by these wastes can endanger the health of animals and humans, resulting in the biodiversity loss of vulnerable species. Heavy metals, flame retardants, and other dangerous pollutants enter the soil when garbage is dumped illegally in landfills, contaminating surface and groundwater. Toxins in the surrounding soil might be taken up by plants. These toxins can then be transported into the human body, where they can cause a variety of health problems. Water contaminated with these toxins is reported in e-recycling towns in China like Guiyu. The water of rivers and their sediments contain a high concentration of heavy metals (Perkins *et al*., 2014). Toxic components from e-waste end up in water streams, where they eventually pollute the marine ecosystem.

Conclusion

Our planet is a dynamic ecosystem. An ecosystem's components coexist with one another. A contaminant in one component can easily enter another. It is critical to remember that the ecosystem's delicate balance between these many components should not be disturbed. Humans have been extracting their requirements from the environment indefinitely without restoring or replenishing it. The world is full of breakthroughs and inventions, but a rising issue is the excessive entry of new dangerous and unnatural compounds into the environment. Humans must recognize that we are reliant on our surroundings to meet our requirements. No society can exist without the use of man-made materials. To survive, we all rely on the atmosphere, lithosphere, and hydrosphere. The recent pandemic taught us the importance of oxygen, which was always freely available. Humans must come to recognize and value the significance of the environment and its components and take steps to protect them. We all study environmental sciences in school, but we rarely learn about the toxins that we encounter in our daily lives. The first step in taking action will be to educate people about the adverse consequences of emerging pollutants that are present in our daily lives.

Future perspectives

The study of emerging pollutants of environmental concern will aid in addressing the problem before they have a significant impact on the environment and human health. It is necessary to research the various sources of these pollutants, their fate in the ecosystem, and their effects on the environment and human health. Research into the effects of these contaminants on human health is still in its early stages. Furthermore, study and research should be concentrated on the development of environmental alternatives that are less damaging and dangerous.

References

1. Aneja, V., Schlesinger, W., & Erisman, J. (2009). Effects of Agriculture upon the Air Quality and Climate: Research, Policy, and Regulations. *Environmental Science & Technology*, *43*(12), 4234-4240.

2. Bell, K., Wells, M., Traexler, K., Pellegrin, M., Morse, A., & Bandy, J. (2011). Emerging Pollutants. *Water Environment Research*, *83*(10), 1906-1984.
3. Boudh, S., & Singh, J. Pesticide Contamination: Environmental Problems and Remediation Strategies.
4. Brausch, J., & Rand, G. (2011). A review of personal care products in the aquatic environment: Environmental concentrations and toxicity. *Chemosphere*, *82*(11), 1518-1532.
5. Bundschuh, M., Filser, J., Lüderwald, S., McKee, M., Metreveli, G., & Schaumann, G. et al. (2018). Nanoparticles in the environment: where do we come from, where do we go to?. *Environmental Sciences Europe*, *30*(1).
6. Cauwenberghe, L.V., Vanreusel, A., Mees, J., Janssen, C.R. (2013). Microplastic pollution in deep-sea sediments. *Environmental pollution 182*, 495-499.
7. Halden, R., & Paull, D. (2005). Co-Occurrence of Triclocarban and Triclosan in U.S. Water Resources. *Environmental Science & Technology*, *39*(6), 1420-1426.
8. Mittal, R. (2013). Impact of population explosion on environment. *We school knowledge builder- the national journal*.
9. Niinimäki, K., Peters, G., Dahlbo, H., Perry, P., Rissanen, T., & Gwilt, A. (2020). The environmental price of fast fashion. *Nature Reviews Earth & Environment*, *1*(4), 189-200.
10. Ojoghoro, J., Scrimshaw, M., & Sumpter, J. (2021). Steroid hormones in the aquatic environment. *Science of The Total Environment*, *792*, 148306.
11. Paustian, K., Babcock, B A., Hatfield, J., Lal, R., McCarl, B A., McLaughlin, S., Mosier, A., Rice, C., Robertson, G P., Rosenberg, N J., Rosenzweig, C., Schlesinger, WH., Zilberman, D. (2004). *Agricultural mitigation of greenhouse gases: science and policy options*. CAST (Council on agricultural science and technology).
12. Perkins N., D., Brune Drisse, M., Nxele, T., & D. Sly, P. (2014). E-Waste: A Global Hazard. *Annals of Global Health*, *80*(4), 286.
13. Phoon, B., Ong, C., Mohamed Saheed, M., Show, P., Chang, J., & Ling, T. et al. (2020). Conventional and emerging technologies for removal of antibiotics from wastewater. *Journal Of Hazardous Materials*, *400*, 122961.
14. Prakash, S. and Verma, A.K. (2014). Effect of Organophosphorus Pesticide (Chlorpyrifos) on the Haematology of *Heteropneustes fossilis* (Bloch). *International Journal of Fauna and Biological Studies.* 1(5): 95-98.
15. Prakash, S. and Verma, A.K. (2021). Toxic Effect of Organophosphorous Pesticide, Phorate on the Biochemical Parameters and Recovery Response of Freshwater Snake Headed Fish, *Channa*

punctatus. *Bulletin of Pure and Applied Sciences-Zoology*. 40A (2): 291-297.

16. Prakash, S. and Verma, A.K. (2022). Anthropogenic activities and Biodiversity threats. *International Journal of Biological Innovations.* 4(1): 94-103.
17. Prakash, Sadguru and Verma, A.K. (2020). Effect of organophosphorus pesticides on Biomolecules of fresh water fish, *Heteropneustes fossilis* (Bloch). *Indian Journal of Biology*. 7(2): 65-69.
18. Qi, R., Jones, D., Li, Z., Liu, Q., & Yan, C. (2020). Behavior of microplastics and plastic film residues in the soil environment: A critical review. *Science Of The Total Environment*, *703*, 134722.
19. Sharma, Shivika., Chatterjee, S. (2017). Microplastic pollution, a threat to marine ecosystem and human health: a short review. *Environmental science and pollution research 24 (27)*, 21530- 21547.
20. Silva, L., Santosh, M., Schindler, M., Gasparotto, J., Dotto, G., Oliveira, M., &Hochella Jr., M. (2021). Nanoparticles in fossil and mineral fuel sectors and their impact on environment and human health: A review and perspective. *Gondwana Research*, *92*, 184-201.
21. Sumner, N.R., Guitart, C., Fuentes, G., Readman, J.W. (2010). Inputs and distributions of synthetic musk fragrances in an estuarine and coastal environment; a case study. *Environmental pollution, 158 (1),* 215- 222.
22. Sutton, M. (2018). *Air Pollution from Agriculture*. Air quality expert group.
23. Verma, A. K. and Prakash, S. (2022). Microplastics as an emerging threat to the fresh water fishes: A review. *International Journal of Biological Innovations*. 4(2): 368-374.
24. Verma, A.K. (2017). Necessity of Ecological Balance for Widespread Biodiversity. *Indian Journal of Biology*. 4(2): 158-160.
25. Verma, A.K. and Prakash, S. (2020). E-wastes and their impact on environment and public health. *International Journal of Applied Research*. 6(9): 164-168.
26. Yu, D., Yu, K., & Tan, R. (2020). Implications of the pandemic-induced electronic equipment demand surge on essential technology metals. *Cleaner and Responsible Consumption*, *1*, 100005.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 134 - 138|

Environmental Accounting for Sustainable Development

Rajeev Kumar[1]* and Meena Wagde[2]

[1]School of Studies in Law, Vikram University, Ujjain (M.P.)

[2]B.K.S.N. Govt. P.G. College, Shajapur (M.P.)

*Corresponding author: rajeevk.kumar679@gmail.com

Abstract

Human activities and man's insensitivity to the environment have been the major causes of the depletion of flora and fauna. Along with humans, all of the surrounding flora and fauna have an impact on the environment. Today's environmental degradation problems are getting larger in scale. Rapid industrial development has an impact on the country as a whole as well as the economics, public health, working conditions, and other humanitarian aspects of the sector. In fact, the rapid rate of industrialization resulted in an increased rate of exploitation of natural resources. Every type of economic activity has a negative impact on the environment and social resources around the world. The issue has gotten worse as a result of industrialization and globalization.

Keywords: Environment, Sustainable Development, Natural Resources, Pollution, Degradation.

Introduction

Pollution prevention and control are needed to preserve precious environmental resources and to improve the environmental quality so that the preserved resources can be utilized for the benefit of mankind and the improvement of the health and well-being of the people. With the advancement in Science and Technology, the corporate sector, and fast pace establishment of factories and industries, and another productive technological process the direct consumption of natural resources for the satisfaction of needs of products and services has increased. Environment degradation and natural resources are diminishing for this reason so it is necessary that actual consideration of the needs of the future generation should be seen. Sustainable development promotes the conservation and preservation of natural resources and the environment and also helps in the management of energy, waste, and transportation. The Stockholm Declaration of 1972 or the declaration of the United Nations Conference on the human environment is the first United Nations declaration on the global environment. The Environment (Protection) Act 1986 and several rules under this Act have been made to prevent, control, and mitigate all forms of pollution.

Sustainable development of natural resources includes the proper management of natural resources for the benefit of the entire human community. The main aim of sustainable development is to provide resources for present generations without compromising the need of future generations. Resources are useful to humans. Resources are actually stocks of nature like soil, minerals, water, coal, forests, and more but because of increasing population and technological development, our natural resources are getting polluted and depleted.

Today's environmental pollution problems are becoming larger in scale. The corporate activities have a direct and indirect bearing upon the economic, health, labour, and environmental measures and more humanitarian aspects of individuals and hence of the nation as a whole. Rapid industrial development has given economic prosperity to human society. It has also given a new socio-economic structure and has provided material comfort to the people of industrially developed countries, but it has also created manifold environmental problems. In fact, the glittering aspects of industrialization have affected the minds of the general public that industrialization is now being considered as the parameter of modernity and a necessary element of the socioeconomic development of a nation. In fact, the rapid rate of industrialization has resulted in a rapid rate of exploitation of natural resources and increased industrial output. Both the components of industrial development i.e. the exploitation of natural resources and industries have created several lethal environmental production problems. Besides desired production, there are numerous undesired outputs from the factories such as industrial wastes, polluted water, toxic gases, chemical precipitates, aerosol ashes, smoke, etc. which pollute air, water, land, soils, etc, and thus degrade the environment. The industrialized countries have increased the concentration of pollutants emitted from the factories in the air, water, land soils, etc, and thus degrade the environment. The industrialized countries have increased the concentration of pollutants emitted from the factories in the air, water, and land to such an extent that they have degraded the environment to the critical limit and have brought human society to the brink of its destruction. The adverse effects of industrialization may change the overall character of the natural system and the chain- effects sometimes suicidal for human society.

With the advancement in Science and Technology, the corporate sector is growing at a very fast pace establishing progress in social, economic, and other human development aspects. They have caused undesirable changes in the physical, chemical, and biological properties of the land, air, and water all polluting the environment of living beings. Industrialization and globalization have accelerated the problem. The rapidly degrading environment, the increasing

consciousness among the citizens and the high visibility of the people's movement all over the world in recent years have also countries to formulate more laws and policies with respect to the environment, and the economic and social security of the society. Environmental legislation is a collection of laws and regulations regarding water quality, are quality of endangered wildlife, and several environmental factors.

The Indian Judiciary has played a very important role in promoting sustainable development and public Interest litigation (PIL) under articles 32 and 226 of the Indian Constitution. In India, there are many provisions related to the environment. Article 21 guarantees the fundamental right to life, the right to an environment free of the danger of disease and infection inherent in it. Article 48 related to the state shall endeavor to protect and improve the environment and safeguard forests and wildlife. Article 51A(g) is related to protecting and improving the natural environment as forests, river lakes and wildlife. Article 253 deals with provisions related to legislation for giving effect to international agreements.

Motivation

Sustainability is the characteristic of a process of the state that can be maintained at a certain level indefinitely. Focusing on the best results for people and the environment now and in the foreseeable future is what sustainability is all about. Ending poverty, safeguarding the environment, and ensuring that everyone lives in peace and prosperity are the goals of sustainable development.

Objectives

* Sustainable utilization of natural resources is the proper management of natural resources for the benefit of the entire human community.

* The goal of sustainable development is to provide resources for the use of the present population without compromising the availability of these resources for future generations.

* Legal system relating to prevention and control of pollution for environmental protection.

* To evaluate general environmental laws and rules incorporated in India.

Research questions

*Whether industries are actually performing to save the environment?

* Whether there is a need to change the law of the environment?

Conclusion

The methodology adopted for the research paper is a doctrinaire method. The research is presented in such a way that studies the selected problem in its entirety, so that one may not have any difficulty. In understanding the problems and perspectives of the present study on right to life in relation to the environment and sustainable development of natural resources. The

sources adopted for this paper are doctrinal, analytical, and descriptive. The presenter is mainly dependent on primary sources like statutes and research commissions, expert reports, and secondary sources like books, articles, journals, case laws, and websites. The Internet has provided a major contribution of the most relevant and latest information on the web which has helped the researcher to explore the subject through various dimensions of the environment and sustainable development of natural resources in the protection of environmental law, also visited e-resources have played a crucial role in bringing out special material for this research.

Sustainable developmental focuses on equal economic growth that generates wealth for all without harming the environment. Conservation is the care and protection of these resources so that they can persist for future generations. Sustainable development of natural resources is the proper management of the natural community. Environmental sustainability improved air quality and water quality increases in biodiversity and preserves land. Environmental management of how humans impact the environment sustainable development consists of three types economic sustainability, environmental sustainability, and social sustainability.

Sustainable development brings out stability in the requirements of the environment. It makes the resources available for future generations. Sustainable development is an amazing way to conserve the resources provided by nature. Sustainable development promotes the idea that social environmental and economic progress are all attainable within the limits of our earth's natural resources. We are aware of our environment, environmental issues, and ways by which we can initiate to save our environment. Natural resources are components of the environment such as animals, water, air, and earth. The Environment (Protection) Act 1986 and several rules under this act have been made to prevent, control, and mitigate all forms of pollution.

Bibliography

1. Baumol, W.J and oates, W. E. (1988). Theory of Environmental Policy, second edn, Prentice-Hall, Englewood cliffs, N.J.
2. Adger Neil, Winkles Alexandra (2007). Vulnerability, poverty and sustaining wellbeing. published in Handbook of Sustainable Development, Edward Elgar Publishing Limited, Cheltenham.
3. Ahmad, Y.J. Serafy, S. E and Lutz, E. (eds) (1989). Environmental Accounting for Sustainable Development, The World Bank, Washington, D.C.
4. Asefa, Sisay (2005). The Concept of Sustainable Development: An Introduction, published in The Economics of Sustainable Development, W.E. Upjohn Institute for Employment Research, Michigan.
5. Boddingtion, M. (1996).'Training issues for sustainable agriculture and

rural development, in S.A. Breath (ed.), Integration of Sustainable Agriculture and Rural Development Issues in Agricultural Policy, Winrock International Instutute for Agricultural Development, Morriltion Arkansas.

6. Bartlett, Albert (2006). Reflections on Sustainability. Population Growth and the Environment. Published in The Future of Sustainability, Springer, Dordrecht.
7. Bromley, D. W. and Cernea, M.M. (1989). The Management of Common Property Resources, Discussion Paper's 57, The World Bank, Washington, D.C.
8. Camhis, Marios (2006). Sustainable Development and Urbanization, published in The Future of Sustainability, Springer, Dordrecht.
9. Becherman, W. (1992). 'Economu growth and the environment: Whose growth? Whose environment? World Development 20 (4): 481-496.
10. Cole, Matthew (2007). Economic growth and the environment published in Handbook of Sustainable Development, Edward Elgar Publishing Limited, Cheltenham.
11. Nelson, Lisa (2007). The role of the United Nations: from Stockholm to Johannesburg. Published in Handbook of Globalization and the Environment, CRC Press, Boca Raton.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 139 - 145|

Development of New Biotechnological Tools in Crop Improvements

Richa Mahant[1]* and Renu Sharma[2]

[1]Center for Food Technology, Jiwaji University, Gwalior (M.P.)

[2]Department of Biotechnology, A.K.S University, Satna (M.P.)

*Corresponding author: richamahant13@gmail.com

Abstract

Biotechnological techniques have undergone rapid development adding novel and valuable tools for plant breeders. These techniques make it possible to create desirable crop cultivars in fast and more efficient ways to meet the demand for improved crops to support sustainable agricultural productivity and in order to cater for the ever-increasing world population. The new biotechnological techniques have one common goal i.e., precise, fast, and efficient crop improvement, individually they are different in approach from one other. Some of these techniques such as Tissue culture methods, Micropropagation technology, Marker assisted selection, Transgenics offer a rich scope for creation, conservation, and utilization of genetic variability for the improvement of field, fruit, vegetable, and forest crops, and medicinal/aromatic plants. During the past 25 years, remarkable achievements have been made in the production, characterization, field evaluation, and release of transgenic varieties/hybrids in several crops. Transgenic varieties/hybrids of maize, cotton, soybean, potato, tomato, and papaya are now being commercially grown all over the world.

Keywords: Biotechnology, micropropagation, transgenics, molecular markers, crop improvement.

Introduction

The growing rate of world's population resulting increased number of hungry and malnourished people. This condition realized the importance of innovation in agriculture to address global challenges such as population growth and climate change. Biotechnological strategies useful in crop improvement (figure 1) include, the molecular markers for the assessment of genetic diversity and marker-assisted breeding, plant tissue culture for mass propagation, genetic modification for novel trait integration, and omics e.g. genomics, proteomics and metabolomics for unravelling gene function and regulation (Dawson et al., 2019; Obembe, 2019). Conventional breeding for genetic improvement of crops is a slow and difficult process (Petri and Burgos, 2005; Rai and Shekhawat, 2014). Furthermore,

improvement of crops using conventional breewding methods is a long-term process because of their long generation time. New biotechnological tools including genetic engineering methods can promote the prompt insertion of important genes into the genome of commercial cultivars, thus resulting in more efficient and reliable genetic improvement (Lusser et al., 2012) of clonal propagated Plants,

maintaining high stability of the major traits of the clone. The introduction of recombinant DNA technology paved the way for an immense potential in the field of plant biotechnology. In order to attain food security and to guarantee nutritional quality, New biotechnological methods for generating genetically modified (GM) plants with useful agronomic and quality traits are already of high significance for many crops (Datta, 2013).

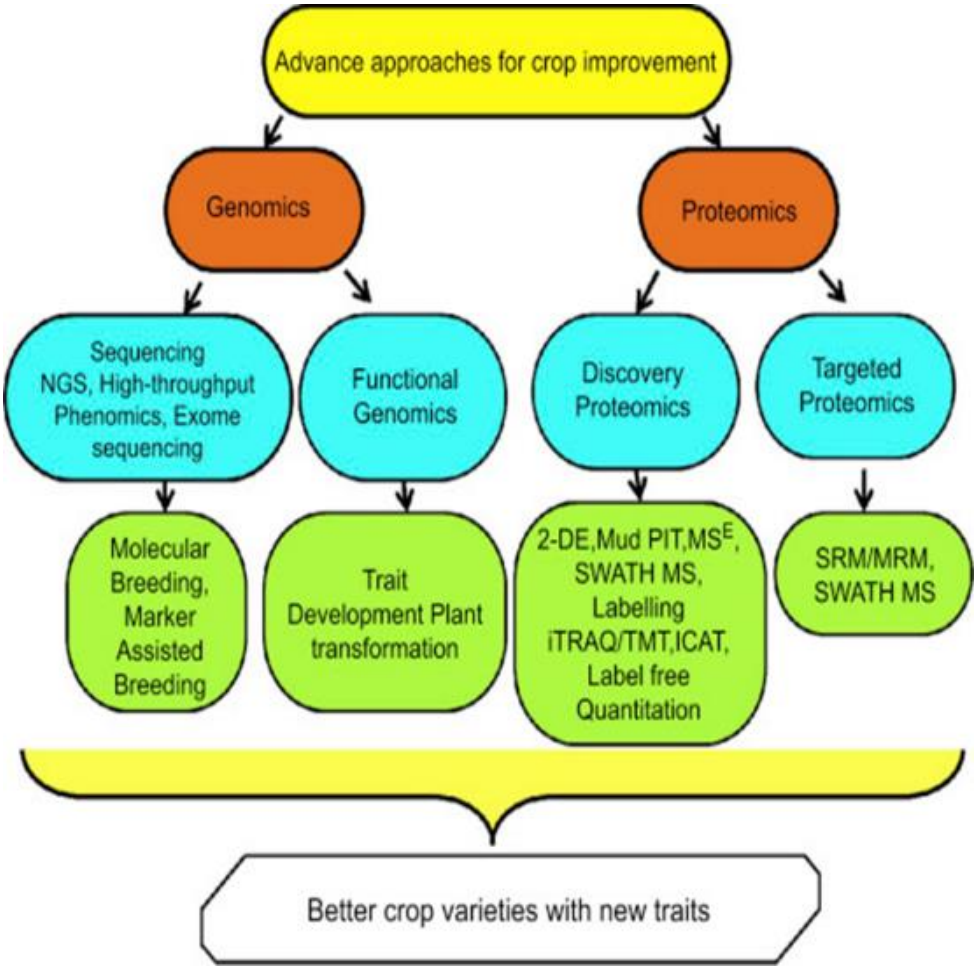


Figure 1: Biotechnology tools in crop improvements (source: Pathak et al., 2017)

Crop improvement methods

The broad applications of biotechnology in agriculture, specifically in crops, include the development of gene-based markers, biofortification, nanotechnology, use of molecular markers, genetic engineering and tissue culture to help in supplying the increasing needs of food to continuously growing world's population (Sharma et al., 2002). Molecular breeding approaches are most efficient in enhancing the biotic and abiotic stress adaptation of crop plants, and recent advances in high throughput genotyping, sequencing and phenotyping platforms (phenomics) have transformed molecular breeding to genomics assisted breeding (GAB). Most commonly used approaches for genomics assisted breeding are marker assisted selection (MAS) and genomic selection (GS). MAS, includes marker assisted backcrossing, gene pyramiding, mapping for associated targeted traits by specific genes or QTLs, fine mapping of QTL region etc (Datta et al., 2013; Waseem et al., 2021). Different crops, improved by current and advance methods are shown on table no.1.

Plant Tissue Culture

Plant tissue culture is defined as "cultivation of different plant parts, from single cell to various tissues and organs on nutrient medium under aseptic condition" (Waseem et al., 2021). Depending upon the part of plant used for regeneration, plant tissues culture technique sare micropropagation, somatic embryogenesis, somaclonal variation, meristem culture, antherculture, embryo culture, protoplast culture (Adalak et al., 2019).

Presence of genetic variation in plants developed through in vitro culture is referred as somaclonal variation. Somaclonal variation can be used to improve the already present clones in asexually propagated crops, e.g., garlic, ginger, turmeric, rose, and ornamental geophytes. Somaclonal variants showed a good impact on plant growth, tuber formation, compactness of plant, and uniformity in maturity of plants. Somaclonal variants of potato had also shown salt tolerance and drought resistance (Datta et al., 2013).

Somatic hybridization is also called somatic fusion or protoplast fusion. Somatic hybridization is actually genetic modification for bringing the characteristics of two distinct or same species into a single cell or organism in vitro by fusing the two protoplasts. Somatic hybridization helps in production of new species, which have all the qualities of parent organisms or even better. This technique is helpful for making herbicide resistance, cytoplasmic male sterility (CMS), disease resistance, response to toxin and antibiotic resistance, varieties (Gosal et al., 2010).

Table1: The major field crops improved by using Biotechnology (Sharma et al., 2002)

S. No.	Crops	Biotechnological techniques	Type of improvement
1.	Chickpea	Tissue culture/wide hybridization; Marker assisted selection; Transgenics	Adaptation to drought and chilling tolerance, Resistance to wilt, Ascochyta blight, and Helicoverpa.
2.	Wheat	Marker assisted selection, Transgenics	Yield, quality, and adaptation, Resistance to rusts and Karnal bunt.
3.	Rice	Marker assisted selection, Transgenics	Rice Drought and salinity tolerance, Resistance to stem borers, brown hoppers, gall midge, and leaf sheath blight, Nutritional and table quality of grains, Resistance to lodging.
4.	Pearl millet	Marker assisted selection, Transgenics	Yield and adaptation to drought, Resistance to downy mildew, stem borers, and head miner.
5.	Maize	Marker assisted selection, Transgenics	Yield and quality, Resistance to lodging and stem borers.
6.	Sorghum	Tissue culture/wide hybridization; Marker assisted selection; Transgenics	Yield, quality, and adaptation to drought, Resistance to shoot fly, stem borer, midge, head bugs, and grain molds.
7.	Mustard	Tissue culture/wide hybridization; Marker assisted selection; Transgenics	Yield and adaptation to drought, Oil content and quality, Resistance to aphids.
8.	Sugarcane	Marker assisted selection, Transgenics	Resistance to stem borers; Yield and induction of early maturity.
9.	Groundnut	Tissue culture/wide hybridization; Marker assisted selection; Transgenics	Yield, oil content, and adaptation to drought, Resistance to foliar diseases, aflatoxins, and leaf miner.
10.	Pigeon pea	Tissue culture/wide hybridization; Marker assisted selection; Transgenics	Yield and adaptation to drought, Resistance to Helicoverpa and Fusarium wilt.
11.	Cotton	Tissue culture/wide hybridization; Marker assisted selection; Transgenics	Yield, fiber quality, and oil content, Resistance to jassids, and bollworms.

Table1: The major field crops improved by using Biotechnology (Sharma et al., 2002)

Genetic Engineering

One or several genes coding for desirable traits have been inserted through the process of genetic engineering (GE). The gene to develop transgene is originated from the same or other species and organisms unrelated to the recipient organism. Transgenic technology is a gene transfer process from same or unrelated species to desired crop plant species for genetic analysis and direct manipulation of DNA (Verma, 2017; Waseem et al., 2021). This gene technology is also known as recombinant DNA technology or transgenic approach.

First generation transgenic crops were insect resistant (IR) maize, cotton, canola and herbicide tolerant (HT) soybean, cotton, maize, sugar beet, alfa alfa plants, expressing bacterial genes CRY and CP4, EPSPS, respectively (Garg et al., 2018). Transgenic approach is used to make genetically engineered tomato and sweet pepper which have longer shelf life that prevent them from rotting and degrading. Introduction of provitamin A and β carotene genes have resulted in the production of golden rice (Ye et al., 2000).

Molecular marker assisted breeding

Molecular markers are piece of DNA which code for specific traits and their inheritance could be detected. Several types of DNA markers that have been developed and are being used in plants include: restriction fragment-length polymorphism (RFLP), amplified fragment-length polymorphism (AFLP), randomly amplified polymorphic DNA (RAPD), sequence-tagged sites (STS), expressed sequence tags (ESTs), and simple sequence repeats (SSRs) or microsatellites, sequence-characterized amplified regions (SCARs), and single nucleotide polymorphisms (SNPs) (Nadeem and Nawaz, 2018; Gosal et al., 2010).

Molecular markers can be used to follow any number of genes during the breeding program. DNA markers are now extensively being used for gene mapping/tagging. molecular markers are also extensively used to probe the level of genetic diversity among different varieties and related species. The applications of such evaluations are many, including DNA profiling, fingerprinting for patenting and IPR issues, efficiently managing genetic resources, and facilitating introgression of chromosomal segments from alien species (Singh et al., 2007; Gosal et al., 2010)

Proteomics

Methods for proteomic study include, separation and identification of proteins through two-dimensional electrophoresis (2-DE), analysis of protein mapping, and protein protein interactions, bioinformatic studies and use of databases for plant species (Holman et al., 2013). Modern plant studies are inclined toward an application of proteomics for understanding the molecular mechanisms of signaling pathways and plant responses to stresses

linking alterations in protein expression to cellular metabolic events. Improvements in proteomic technology with quantitative approaches such as the combination of classical 2-DE gel-based techniques with mass spectrometry as well as the accessibility of information available in protein databases of various plant species have been used to study quantitative changes in protein abundance in response to various abiotic stresses. Arabidopsis, rice, and sorghum has improved using proteomic technology (Pathak et al., 2017).

Conclusions

To fulfil increasing global food demands, crop productivity can be increased by combining conventional breeding practices with modern breeding practices such as genomic breeding. Rapid advancements in sequencing techniques have aided genomic breeding, which may be helpful in selecting desirable traits of plants with respect to climate change and environmental stress. Molecular marker has paved the way for much cheaper and less time-consuming modes of crop improvement. Although the application of proteomics in plant sciences is new compared with animal and bacterial systems, it has given new insight into the study of stress response and signalling pathways in plants. Genetic manipulation leading to the development of GM crops holds promise for increasing crop productivity**.**

References

1. Adlak, Tinee & Tiwari, Sushma & Tripathi, Manoj & Gupta, Neha & Sahu, Vinod & Bhawar, Punamchand & Kandalkar, Vasant. (2019). Biotechnology: An Advanced Tool for Crop Improvement. Current Journal of Applied Science and Technology. 1-11.
2. Datta, A. (2013). Genetic engineering for improving quality and productivity of crops. Agric & Food Secur 2, 15.
3. Dawson I.K., Hedley P.E., Guarino L., Jaenicke H. (2009). Does biotechnology have a role in the promotion of underutilised crops? Food Pol. 34:319–328.
4. Garg M, Sharma N, Sharma S, KapoorP, Kumar A, Chunduri V and Arora P. (2018). Biofortified Crops Generated by Breeding, Agronomy, and Transgenic Approaches are Improving Lives of Millions of People around the World. Frontiers in Nutrition.
5. Gosal, Satbir S.; Wani, Shabir H.; Kang, Manjit S. (2010). Biotechnology and Crop Improvement. Journal of Crop Improvement, 24(2), 153–217.
6. Holman J.D., Dasari S., Tabb D.L. (2013). Informatics of protein and post-translational modification detection via shotgun proteomics, Methods in Molecular Biology 1002, 167-179.
7. Lusser, M., Parisi, C., Plan, D. (2012) Deployment of new biotechnologies in plant breeding. Nat Biotechnol 30, 231–239.
8. Nadeem M.A., Nawaz M.A. (2018). DNA molecular markers in plant

breeding: current status and recent advancements in genomic selection and genome editing. Biotechnology and Biotechnological Equipment.32 (2):261-285

9. Obembe O. (2019). Vol. 9. Covenant University; Ota: Subdue and Dominate the Earth: Plant Biotechnology for Sustainable Development. Inaugural Lecture Series.
10. Pathak, J., Rajneesh, Pandey, A., Singh, S. P., & Sinha, R. P. (2017). World Agriculture and Impact of Biotechnology. Current Devts. in Biotechnology and Bioengineering, 1–22.
11. Petri, César & Burgos, Lorenzo (2005). Transformation of fruit trees. Useful breeding tool or continued future prospect? Transgenic research. 14. 15-26.
12. Rai, M.K., Shekhawat, (2014). N.S. Recent advances in genetic engineering for improvement of fruit crops. Plant Cell Tiss Organ Cult 116, 1–15.
13. Sharma H.C., Crouch J.H., K.K. Sharma, Seetharama N., Hash C.T. (2002). Applications of biotechnology for crop improvement: prospects and constraints. Plant Science 163, 381/395.
14. Verma, A.K. (2017). A Handbook of Zoology, Shri Balaji Publications, Muzaffarnagar. 1-648p.
15. Waseem, Rashad & Qadri, Rashad & Fatima, Bilquees & Jaskani, Muhammad & Khan, Iqrar & Farooq, Ahmad Sattar & Ziaf, Khurram. (2021). Biotechnology and Crop Improvement. Horticulture: Science & Technology.
16. Ye X, Al-Babili S, Klöti A, Zhang J, Lucca P,Beyer P and Potrykus, I. (2000). Engineering the provitamin A (β-carotene) biosynthetic pathway into (carotenoid - free) rice endosperm. Science. 287, 303-305.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 146 - 150|

Socio-Economic Development through Waste Management

Ram Krishna Vishwakarma
Department of Applied Economics, Lucknow University, Lucknow (U.P.)
Corresponding author: ramanv711@gmail.com

Abstract

The socio-economic ramifications of waste management have received very little attention from research outputs. Few studies have focused on the importance of cooperation in high-quality waste management, despite the fact that many have been undertaken on the technological elements of trash management. It has been noted that population growth in the majority of the world's emerging nations has undoubtedly created a number of hazards to both humanity and the ecology as a whole. Municipal solid waste (MSW) creation is on the rise as a result of globalization, industrialisation, and urbanisation processes. The management of MSW is now a major problem for the government, the relevant regulatory organizations, and the departments in charge of pollution control. Solid waste management has faced difficulties as a result of the same problem. The management of solid waste has socioeconomic effects. Solid waste management and social elements like men-women relationships, educational attainment, religious convictions, etc. have a tight association. Different work organisations produce solid garbage on a daily basis. The most effective strategy to gather, recycle, and reuse waste from multiple sources is to do so.

Keywords: Waste Management, benefits, Socio-Economic, Incineration.

Introduction

Waste management is among the key issues for reaching sustainable development and circular economy, nowadays. Wastes have a tremendous impact on the environment and their proper management is of paramount importance in preserving the environment. Thus, their impact on climate change is very high. Science and engineering have spent millions of hours on investigating the methods to improve the waste management methods and mitigate their impact on the environment (Arya and Dubey, 2017). Thousands of papers have proved the importance of proper waste management and recycling on protecting the environment and reduce the climate change impact, providing the benefits of established and innovative methods. The amount of all types of wastes including electronic wastes produced, increases together with the growth in global population (Verma and Prakash, 2020). Anthropogenic activities and improper management of wastes are big threats for environment,

biodiversity and sustainability (Verma, 2019; Arya, 2021; Prakash and Verma, 2022). For environmental sustainability and public health, proper garbage disposal is crucial. Finding efficient waste disposal methods that strike a balance between environmental impact and economic feasibility, however, continues to be a difficult task.

Waste Management Benefits

The primary goal of pre-incident waste management planning is to prepare a community to effectively manage waste, debris and materials generated by a homeland security incident, including reducing the potential amount of waste generated at the outset. Communities can follow EPA's comprehensive Pre-incident All-Hazards Four Step Waste Management (WM) Planning Process or, if resources and time are limited, focus on one or more pre-incident planning activity at a time.

- Saves valuable time and resources during an incident.
- Allows more efficient and effective waste management decision-making during an incident.
- Encourages interested parties (e.g., state, local, tribal and territorial governments; owners of private storage, treatment and disposal facilities; residents) to work together before an incident occurs.
- Boosts the community's resiliency, resulting in a quicker and less costly recovery to its preincident state.
- Enhances communities' adaptation to the waste-related impact of climate change.
- Minimally detracts from, or otherwise impacts, the broader response and recovery efforts due to the efficient implementation of waste management activities.

Planning for Waste Management

- Consult with interested parties.
- Identify potential waste streams.
- Evaluate the reuse and recycling program.
- Consider waste collection strategies.
- Determine locations or criteria for waste management sites.
- Select potential waste management facilities.
- Create a waste management-focused community outreach plan.
- Address health and safety considerations for waste management operations.

Disposable methods

The conventional method of disposing of waste has been landfilling, in which rubbish is buried in specific locations. A simple and reasonably priced technique of trash disposal is landfilling. However, it has a number of negative environmental effects. Landfills have the potential to damage groundwater and discharge dangerous chemicals into the environment, such as methane (Zhang *et al.*, 2021).

Another technique for getting rid of garbage that has been around for a while is incinerating it. Incineration is the burning of garbage to lessen its mass and volume. While burning waste can provide electricity and lessen the quantity of waste that is dumped in

landfills, it also produces air pollutants like dioxins and heavy metals. Many nations have adopted trash reduction and recycling programmes to address the environmental issues related to landfilling and incineration. These initiatives seek to lessen trash production and encourage material reuse. The goal of waste reduction is to reduce the quantity of waste that households and companies produce. Composting, cutting back on packaging waste and reducing food waste are a few ways to do this. The environmental impact of garbage disposal is decreased by minimising the amount of rubbish that must be disposed of (Singh, 2019).

An important method of garbage disposal is recycling. Recycling is the process of gathering and processing materials that would otherwise be discarded to create new products. Recycling lessens the quantity of waste that is delivered to landfills and incinerators, as well as greenhouse gas emissions. Programs for waste reduction and recycling have been effective in many regions, but they are not without difficulties (Madhulekha and Arya, 2016a, 2016b). The expense of executing these programmes is one of the biggest obstacles. Programs for recycling and waste reduction can be expensive to implement because they need for spending on outreach, education, and infrastructure. Contamination of recycling streams is another problem. When recyclable and non-recyclable materials are combined, contamination results, making it challenging and expensive to separate the two (Arya, 2018). The rejection of entire batches of recyclables due to contamination can increase waste disposal costs and threaten the sustainability of recycling programmes (Ciocoiu *et al*., 2016).

Governments and corporations have been investigating creative garbage disposal options that balance environmental impact and commercial feasibility to address these issues. Waste-to-energy (WTE) is one technique that shows promise (Arya *et al.*, 2019). WTE involves producing energy from waste as a fuel source. This can be accomplished either through incineration or another method, like gasification or pyrolysis. WTE can produce fuel, heat, electricity, and reduce the quantity of trash that is disposed of in landfills and incinerators. WTE does not, however, come without difficulties. WTE plants have the potential to produce air pollution and greenhouse gas emissions, as well as being expensive to build and run. The type of waste being processed, the technology being employed, and the management of pollutants and waste residues all affect WTE's environmental effect (Mukherjee *et al.*, 2021).

Another promising strategy is the circular economy. The circular economy aims to keep materials in use for as long as possible, by promoting reuse, repair, and recycling. The circular economy can reduce the amount of waste generated, conserve natural resources, and reduce greenhouse gas emissions. To implement the circular economy, governments and businesses must redesign products and systems to prioritize resource efficiency and waste reduction. This can entail

encouraging the use of long-lasting, repairable, and recyclable items, putting extended producer responsibility programmes into place, and making investments in cutting-edge equipment and infrastructure to support circular practises. In the end, finding efficient waste disposal methods that strike a balance between environmental impact and economic feasibility necessitates a thorough approach that takes the entire waste management system into account. This covers both waste reduction and waste disposal (Esmaeilian *et al.,* 2018). Development may be sustainable and balanced if waste resources are used, handled, and disposed of effectively. This will result in increased production, correct product distribution, effective distribution, and acceptable marketability. The nation will be able to sustain a high quality of life with the aid of effective solid waste management. It is quite evident that effective waste management will instill moral values in the populace. It will promote order and cleanliness across a country. Hygiene and sanitation will be given top importance. People will be healthy, and diseases will decline. Use of innovative technology for waste management will be encouraged by effective waste management. Utilizing solid waste effectively would aid in the development of a network society where many specialists and stakeholders from various industries will come together to create a sustainable country.

References

1. Arya S, Sidharth BR, Saxena SK and Patel G (2019). ISOLATION OF PHENOL DEGRADING BACTERIA FROM INDUSTRIAL WASTE. *Life Science Bulletin*. 15(1): 47-50.
2. Arya S. (2018). Vermicomposting: Profitable Organic Fertilizer. *Academic Social Research* 4(1): 7-10.
3. Arya S. and Dubey R (2017). Physico-Chemical and Scientific Analysis of Ganga River Water with Special Respect to Bacteriophage Activity and Its Comparative Studies with Sewage Water Treatment. *International Journal of Innovative Research in Science, Engineering and Technology* 6 (3): 5094-5104.
4. Arya, S. (2021). Freshwater Biodiversity and Conservation Challenges: A Review. *International Journal of Biological Innovations.* 3 (1): 74-78.
5. Ciocoiu CN, Colesca SE, and Rudăreanu C (2016). Management of waste electrical and electronic equipment in Romania: A mini-review. *Waste Manag Res.*34(2):96-106.
6. EPA, United States Environmental Protection Agency, 2023:Waste Management Benefits, Planning and Mitigation Activities for Homeland Security Incidents.
7. Esmaeilian B, Wang B and Lewis K (2018). The future of waste management in smart and sustainable cities: A review and

concept paper. *Waste Manag.* 2018; 81:177-95.

8. Madhulekha and Arya, S (2016 a). Evaluation of Water Quality in River Ganga Due to Contaminant of Heavy Metals, Kanpur (India). *International Journal of Innovative Trends in Engineering*
9. Madhulekha and Arya, S (2016b). Assessment of Water Pollution of River Ganga by Tannery Effluent Using Fish as an Indicator in Kanpur, India. *Journal of Biochemical and Cellular Archives*. 16(1): 120-123.
10. Mukherjee AG, Wanjari UR and Chakraborty R (2021). A review on modern and smart technologies for efficient waste disposal and management. *J Environ Manag. 297:113347.*
11. Prakash, S. and Verma, A.K. (2022). Anthropogenic activities and Biodiversity threats. *International Journal of Biological Innovations*. 4(1): 94-103.
12. Singh A (2019). Remote sensing and GIS applications for municipal waste management. *J Environ Manag. 243:22-9.*
13. Verma, A.K. (2019). Sustainable Development and Environmental Ethics. *International Journal on Environmental Sciences.* 10 (1): 1-5.
14. Verma, A.K. and Prakash, S. (2020). E-wastes and their impact on environment and public health. *International Journal of Applied Research*. 6(9): 164-168.
15. Zhang J, Qin and Li G (2021). Sustainable municipal waste management strategies through life cycle assessment method: A review. *J Environ Health.*287:112238.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 151 - 156|

Environmental balance: Need for Conservation and Protection

Ramesh Chandra Mishra[1], Madhu Laxmi Sharma[2]*, Seema Margret Singh[3]
[1]Mahakaushal University, Jabalpur (M.P.)
[2]Department of Botany, Govt. KRG PG (Auto.) College, Gwalior (M.P.)
[3]Department of Botany, Govt. PG (Auto.) College, Datia (M.P.)
*Corresponding author: madhulaxmisharma@gmail.com

Abstract

The environment can be broadly classified into two groups based on its fundamental structure: the physical environment, which includes the lithosphere, hydrosphere, and atmosphere. The biotic part of the ecosystem is made up of plants and animals, with man as a significant component. The ecological balance of nature is disrupted as a result of intensive industrialization, enormous urbanization, careless chemical usage, and increasing nuclear energy consumption. This has led to pollution of every component of nature, notably the biotic component. In other words, this ecological imbalance has caused an unfavourable change in our air, land, and water's physical, chemical, or biological characteristics, which may or may not adversely affect human life or the lives of desirable species, living conditions, cultural assets, or our raw material resources. Environmental conservation and protection are the great necessities of today for every person.

Keywords: Environmental imbalance, Sustainable development, Conservation.

The English word Environment was derived from the French word “Environir” which means to surround. Therefore, the term "environment" refers to the whole of the factors that surround a person at a certain moment and place. It is a collective term for the surroundings in which living things exist. It consists of both biotic and abiotic elements. In other words, environment refers to the entire set of individual and collective physical, social, and biological components that make up the natural and artificial surrounds (Ashok, 2016). Environmental conservation and protection have grown in importance in both developed and developing nations in the twenty-first century. The environment serves four essential purposes. (i) It provides resources, which can be both renewable and non-renewable. Resources that may be utilised again without running out or getting depleted are known as renewable resources. In other words, there is a constant supply of the resource. The trees in forests and the fish in the sea are two examples of renewable resources. On the other hand, non-renewable resources are those that run out with extraction and usage, such fossil fuel, which (i) assimilates waste (ii),

maintains life by giving genetic and biological diversity, and (iii) also offers aesthetic benefits like scenery and other things.

Man is the most highly developed, intelligent, and civilised organism there is. He not only shapes his surroundings, but also creates it. Man has greatly advanced science and technology, which has enabled him to dominate and control much of nature. Man has tampered with nature and upset his biotic and abiotic environment in the process through anthropogenic activities (Prakash and Verma, 2022). A number of specific environmental issues can impede human health and wellness. These issues include chemical pollution, air pollution, climate change, disease-causing microbes, lack of access to health care, poor infrastructure, and poor water quality.

Without a healthy ecology, human existence is virtually impossible. All elements in our environment, both living and non-living, interact with one another in a natural setting. One of the most important concerns that must be addressed in the fight against climate change and global warming is environmental protection. The world urgently needs sustainable development if we are to protect Mother Earth from the effects of industrialization. In this article, we'll go into more detail on environmental preservation, including its requirements and methods.

This imbalance has caused a rise in global warming, ecosystem changes, different kinds of natural disasters, and so on (Prakash, 2021; Verma, 2021; Ambasht, 2022). The earth's temperature increased by 6°C as a result of increased global warming. Because of the glaciers' steady melting caused by this temperature rise, the sea level is rising. The existence of island nations like Sri Lanka, the Maldives, and the West Indies, among others, is threatened by this rise in sea level. Due to ecological imbalance, every day, on average, 20 species disappear from the planet. Extinction events undoubtedly occur often in India, particularly among some of the smaller and less well-known creatures like insects and fungus. In actuality, higher-level plant and animal extinctions are more likely to be noticed than lower-level ones.

According to projections, we could lose up to one-third of all wild species in the country within the next few decades due to the widespread loss of ecosystems across the nation. Environmental imbalance can increase the chances of contracting heart diseases, cancers, and various other illnesses. Ecological balance is necessary for rich biodiversity and human survival (Ashok, 2017; Verma, 2018). Loss of biodiversity has bad impact and to save it is big challenge for sustainable development (Kumar and Verma, 2017; Ashok, 2019; Arya, 2021). Untreated drinking water, poor hygiene, and improper sanitation cause infectious diseases such as cholera, diarrhoea, dengue, etc. It must be emphasized that these risks are just some examples for illustration, and are by no means comprehensive. Earth has undergone many periods of significant environmental change, and it can be

generally divided into three phases over the past 12,000 years.

In addition, not only our nation but the entire world is affected by various types of pollution, such as air pollution brought on by the excessive emission of harmful fuel gases, industrial smoke wastes, etc., as well as the widespread emission of CFCs (chlorofluorocarbons) and radioactive waste from nuclear power plants. Due to the discharge of home and industrial garbage, sewage waste, chemical fertiliser residues, etc. into the river, there is water contamination. High levels of soil erosion, excessive use of chemical fertilizers, biocides (pesticides, insecticides, and herbicides), contaminated liquids and solids from urban and industrial regions, forest fires, water logging, etc. are all causes of soil or land pollution. Noise pollution brought on by increased manufacturing and urbanisation.

Trees are a vital component of the biosphere and play a crucial role in the hydrological cycle, however today people are cutting down trees and wasting land by erecting businesses and other structures where numerous useful activities could be carried out. Therefore, all of the nations of the globe were drawn to explore strategies to safeguard nature so that our future generations will be able to breathe in pure air as a result of these circumstances, the rapid degradation of nature, and its alarming effects. Several summits at the worldwide level were held to discuss strategies to conserve the environment and to raise awareness of it. A few significant conferences organised to promote environmental protection include the Johannesburg Summit (2002), Earth Summit (1992), and Montreal Protocol (1987). The subject of environmental degradation brought on by human actions to attain rapid economic expansion, endangering the cycle of life, and sustaining natural resources that future generations will need, was the focus of the Johannesburg Summit on Sustainable Development, which was held on September 4, 2002.

Although environmentalists have been protesting the state of the environment for a while, the Stockholm conference in 1972 marked the first time that these issues were taken seriously on a worldwide scale. However, there was no prompt follow-up action. A global commission on environment and development (the Brundtland commission) wasn't established until almost eleven years after the Stockholm meeting. This committee proposed the idea of "sustainable development" in its landmark report, "Our Common Future (1987)," and urged all countries to address environmental challenges while putting development plans into action. The Rio Earth Summit in 1992, which followed, saw the adoption of a comprehensive plan for sustainable development. The Rio Summit decided to set goals and create timelines.

The Earth Summit II, held in Johannesburg in 2002, reaffirmed the international commitment to sustainable development in order to ensure the relationship between nature's resources and human needs. This meant that

development that depletes natural resources should not go beyond the planet's carrying capacity. It committed to creating a humane, just, and compassionate global society that recognises the importance of human dignity for everyone. The summit acknowledged that eliminating poverty, altering patterns of consumption and production, and safeguarding and managing the natural resource base for economic and social growth are the overarching goals and fundamental elements of sustainable development. In his crucial speech on May 17, 2002, Kofi Annan, the secretary general of the United Nations, were highlighted on Water and sanitation, Energy, Health, Agricultural production and Biodiversity and ecosystem management that are essential for environmental conservation. It is the goal of the WEHAB agenda to provide safe, hygienic water for consumption. It is about using energy in our businesses and industries in a sustainable manner. Making it possible for people to have heating, lighting, and cook food in a way that is significantly less harmful to the environment is the goal. It has to do with having access to good health no matter where you are in the globe. It has to do with having enough area to grow our food and maintaining the biodiversity the earth requires to survive.

After the Stockholm, Sweden, United Nations Conference on Human Environment in 1972, a wave of environmental awareness began to spread over India. The Indian government paid close attention to the environmental issues, and a committee was established as early as 1972. There are currently more than 30 significant laws relating to environmental protection. "To protect and improve the natural environment, including forests, lakes, rivers, and wild life, and to have compassion for living creatures," is one of our fundamental obligations, according to Art. 51A(G). Additionally, our constitution's fundamental principles of state policy, which are stated in Art. 48A, declare that "it should protect and improve the environment and safeguard the forests and wild life of the country." These instructions are rules provided to the federal institutions in charge of the state of India, to be used as a reference while crafting laws and policies. The Wildlife Protection Act and the Forest Act, both established by the Parliament, support the instruction in Art. 48A. For the protection of our environment, the entire globe, including India, has implemented all of the aforementioned actions. But are these actions effective enough to achieve environmental protection objectives? Every citizen of the planet, or the "common man," should participate in this campaign. Government is not the only entity responsible for protecting the environment; we are as well. We can work together on this adventure by adhering to the relevant government regulations and also by coming up with innovative ideas. We can cooperate in this expedition by following government policies in this respect and also to discover new ways towards the usage of natural resources without harming them.

For example, Israel is a small country but it manages the proper use of water.

They clean sewage water and put it to intelligent use. There is no water management in India. China and Israel have completed this process of managing the water. Additionally, there is a significant distinction between ecological awareness and ecological comprehension. Due to ignorance, even well-educated individuals who are aware of the negative effects of environmental exploitation are actively doing so. Highly educated people often engage in smoking, frequent use of motor vehicles, even for short distances, the disposal of human remains and flowers in rivers, the use of plastic bags, and excessive use of electrical appliances like air conditioners and refrigerators. It is crucial that they are aware of the issue and its consequences. This issue can be resolved by changing the settings. People should switch from using non-renewable (fossil) energy to renewable energy with the assistance of the government. A significant source of energy that is both safe and unbreakable is renewable energy, such as wind, solar, tidal, and other forms of energy.

The conservation of the environment is mentioned in the sacred texts, scriptures, Vedas, and Puranas, as well as in the epics Mahabharat and Ramayan. In order to achieve this goal, natural resources such as trees, rivers, mountains, and lands were linked to specific religions so that people would follow them in their daily lives. There were guidelines for environmental preservation in the mediaeval era as well. For the protection of the environment in India, numerous laws, rules, regulations, by-laws, and policies have been developed in the modern era, particularly since independence.

A number of organizations/institutes like Ministry of Environment, Forest and Climate Change; National Green Tribunal; Central Pollution Control Board have been established for the environment management. India has taken a number of steps in this direction, but how far those are relevant, only future will tell, but there is no doubt that since ancient times; there are guidelines and prescription for the environment management.

We can deal with the issue of environmental deterioration if we all abide by the standards set forth in our ancient scriptures and traditions. Therefore, we should satisfy our own needs while not sacrificing those of the next generation. In other words, we should work towards development that is environmentally friendly, economically feasible, and last but not least, socially acceptable. In this regard Gandhiji said that, “There is enough for everybody's need but not for greed”.

References

1. Ambasht, N.K. (2022). Effects of Climate Change on Agricultural crops and Biodiversity: A review. *International Journal of Biological Innovations*. 4(2): 379-384.

2. Arya, S. (2021). Freshwater Biodiversity and Conservation Challenges: A Review. *International*

Journal of Biological Innovations. 3 (1): 74-78.

3. Ashok, K.V. (2016). Biodiversity: Its Different Levels and Values. *International Journal on Environmental Sciences*. 7(2): 143-145.
4. Ashok, K.V. (2017). Necessity of Ecological Balance for Widespread Biodiversity. *Indian Journal of Biology*. 4(2): 158-160.
5. Ashok, K.V. (2019). Sustainable Development and Environmental Ethics. *International Journal on Environmental Sciences.* 10 (1): 1-5.
6. Kumar, Ajay and Verma, A.K. (2017). Biodiversity loss and its Ecological impact in India. *International Journal on Biological Sciences*. 8(2): 156-160.
7. Prakash, S. (2021). Impact of Climate change on Aquatic Ecosystem and its Biodiversity: An overview. *International Journal of Biological Innovations.* 3(2):312-317.
8. Prakash, S. and Verma, A.K. (2022). Anthropogenic activities and Biodiversity threats. *International Journal of Biological Innovations*. 4(1): 94-103.
9. Verma, A.K. (2018). Ecological Balance: An Indispensable Need for Human Survival. *Journal of Experimental Zoology, India*. 21 (1): 407-409.
10. Verma, A.K. (2021). Influence of climate change on balanced ecosystem, biodiversity and sustainable development: An overview. *International Journal of Biological Innovations*. 3(2):331-337.
11. Ehrlich, P. R. & Wilson, E. O. 1991. Biodiversity studies: Science and policy. Science 253: 758-762.
12. Elewa, A.M.T. & Joseph, R. 2009. The history, origin, and causes of mass extinctions. *Journal of Cosmology* 2: 201-220.
13. Foster, J. B. 2002. Ecology against Capitalism. Monthly Review Press, New York.
14. International Union for the Conservation of Nature 2009. IUCN Red List of Threatened
15. Species. Version 2009:1.
16. Jones, Andrew R. 2009. The Next Mass Extinction: Human Evolution or Human Eradication. *Journal of Cosmology* 2: 316-333.
17. Leakey, R. & Lewin, R. 1995. The Sixth Extinction: Patterns of Life and the Future of
18. Humankind. Doubleday Books, New York.
19. https://www.livemint.com/news/world/environmental-degradation-poses-triple-threat-to-humans-un-11613673075875.html
20. https://www.google.com/search?q=Environmental+Imbalance%3A+A+Threat+to+Human+Survival&oq=Environmental+Imbalance%3A+A+Threat+to+Human+Survival&aqs=chrome.69i57.1688j0j15&sourceid=chrome&ie=UTF-8

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 157 - 165|

Biodiversity of Insects on Roses

Riya Sachan and Sunita Arya*
Department of Zoology
Dayanand Girls P.G. College, Kanpur (U.P.)
*Corresponding author: sunitaarya_kn15@csjmu.ac.in

Abstract

Roses are the most exhaustively managed plants in various home gardens, landscapes, and parks. A serious threat to roses cultivation is influenced by various insects, nematodes, and mites of rose plants that damage various parts of the rose plant which reduces flower quality and plant growth. Several insects commonly found as regular pests are aphids, ladybird beetle, false chine bugs, common desert ant, ladybugs, Tobacco caterpillars, Green lacewings, Jewel bugs, and Leaf-cutting bees. Flowers chafer beetles. These rose plant pests are found throughout the year and destroy the rose plants and affect the flower yield. Several insect pests are found in large numbers on the surface of the leaves, flowers, shoots, and buds in the field rose. These pests on roses can approximately 28-75 % damage individually or in a group of fields. Various types of botanicals and cultural practices do reduce the pest population of roses. Insecticides should be applied as and when required.

Keywords: Rose, Insects, Diversity, Kanpur, Aphid.

Introduction

Rose is also called a king of flowers. Rose is one of the most beautiful creatures of nature. For thousands of years, the rose has been a symbol of love, renovation, purity, and other noble virtues. Rose is the most popular ornamental plant and best known of all cut flowers over the world (Leghari, 2016). Rose flowers are used for marriage parties, worshipping, bouquet, and making garlands. Rose oil is used in ayurvedic medicine, cosmetics, soaps and perfumes, alcoholic beverages, and flavoring soft drinks. Rose water is heavily used for candy stores and cooking. Rose water also used syrups, flavoring wines, cakes, Jams, and jellies. Popular ornamental plants for their beauty are rose flowers (Arya, 2018).

Insects occur in all the three types of habits (Verma and Prakash, 2020). Insect biodiversity also play an important role in ecological balance (Ashok, 2016). Several insects and pathogens cause serious damage to the quality of and decrease flowers' growth in the rose field. Rose insects do not kill the rose plants but may inhibit or cause aesthetic damage and kill plant parts (Arya, 2015). At present time an important necessity is to provide better protection against different insect pests to improve the quality and yield of flowers. In certain areas, several nematodes pose a threat to rose flower cultivation (Tyagi *et al.*, 2020). This chapter describes

identification, life history, nature of damage that affects the rose plants, and their management strategies.

INSECT PESTS OF ROSES

1. Aphids (*Macrosiphum rosae)*

Aphids are tiny soft-shelled insects 1-2 mm in length. They migrate from old to the new shoots and buds of roses. Aphids are mostly green but occasionally these are light brown, after some time aphids appear with wings. The aphid colonies are most active during the spring and summer seasons and these cover the whole growing tip of the plant. In aphids, show piercing and sucking mouth parts are found feeding the sap of the plant. Most aphids are located on plants (Singh and Garrima, 2022, Singh *et al.,* 2023). Aphids are soft-shelled small slow-moving insects with piercing and sucking types of mouthparts (Singh, and Agrawal, 2022; Singh and Srivastava, 2022). The aphid shows great diversity (Singh and Singh, 2019). Several species may be found on roses. But the rose aphids *(M. rosae*) are one of the common and dominant species of rose plants (Kmic 2007).

In the reproductive period, female aphids give birth to produce young nymph-aphids who are capable of becoming mothers themselves within a week to 8-10 days. Most aphids are female that are capable to reproduce without mating and consequently parthenogenesis under favorable conditions, aphids can faster reach a higher population. In aphids, nymphs and adults both cause serious damage by piercing and sucking the plant sap. Aphids are concentrated and colonized on flower buds, tender growing tissues. Honeydew is a sticking substance that is secreted by aphids. Honeydew collects on the leaves of roses and supports black fungal growth. This fungal growth is called sooty mould (Mehrparvar *et al.,* 2008).

2. Tobacco caterpillar (*Spodoptera litura)*

This is the one of the most important polyphagous pests of both agriculture and horticulture crops. It is distributed throughout the South and Eastern world Interestingly 112 species of plants belonging to 44 families of approximately image 40 species were reported from India. It also attacks Caster, cotton, groundnut, pulses, tomato, tobacco as well as rose (Ahmad *et al.,* 2013). In the morphology of tobacco caterpillars several stages were found i.e. egg, larva, pupa and adult along with the life cycle. This pest has five instars. The color of an adult moth is brown with a complex pattern of creamy-colored crisscrossing markings on the forewing. The Hind wing appeared Silvery white. The thorax part was covered with bright-colored scales. The total life cycle of tobacco caterpillar was completed 28.35 to 35 days. The yield of crop loss to insect pests varied widely depending on the season (Kumar and Singh, 2021).

3. Green lacewings (*Chrysoperla carnea)*

Stephens, regarded as a field lion, processes a broad range of hosts like thrips, mealy bugs, white flies, and aphids as well as eggs of several arthropods. The green lacewing is a common cosmopolitan polyphagous predator seen in agriculture and ornamental plants. This insect pest is an effective generalist Predator of aphids,

coccids, mites, and mealybugs. The green wing has a large size, transparent pale green color wings, and a dedicated body adult are active flies during the evening and night. Adults are approximately 6 mm long, their dorsum overhead by pale longitudinal strips wings with 5 delicate venations. Green lacewing found complete metamorphosis including life cycle egg, larva, pupa, and adult stages. Eggs are laid singly at the end of slender stalks on foliage and other kinds of substrate. The Development of all stars required about 18 to 20 days. In the larval period, the third instar of chrysoperla carnea fed the maximum number of aphids Instar nymph 1st, 2nd, 3rd (Beerendra *et al.,* 2022*)*. This pest has great potential for the biological control of aphids. Green lace wings are considered a beneficial insect because they eat aphids on Roses and other pests. It is proficient in the larval form at attacking behavior on pests like aphids, white flies, scale insects, and other insects (Tauber *et al.,* 2000: Qadeer, 2012).

4. Flowers chafer beetle (*Oxycetonia versicolor)*

Various species of flower beetle invade the New Hampshire home landscape in the last spring season and early summer season. It attacks priced shrubs, flowers foliage plants of ornamental trees. It is one of the most common pests of horticulture crops. The flower chafer beetle is especially distributed in areas with sandy soils preferred by the larvae. These beautiful chafer beetles feed on more than 400 species of several leaves plants. Including cherries, grapes, black walnuts, Apple as well as Rose plants (Naik, 2019). The adults eat the tissue between the leaf veins; they also attack flower birds of roses and fruits of favorite plant plants (Shanmugam *et al.,* 2020).

5. Cornear worm (*Helicoverpa zea)*

Corn earworm or fall armyworm belongs to the family Noctuidae. The Caterpillar of the moth is a major pest where corn, tomatoes, cotton, and roses are grown. It is a worm season pest with a broad host range, particularly cotton. Adult moths have a wingspan of 30-40 mm and are light brown to red-brown with a dark band along the lower edge. The larvae grow up to 2 inches long and have thorny microphones. Larvae have green, pink, brown, or yellow. The complete life cycle of *Helicoverpa zea* consists of an egg larva pupa and an adult. Adults are light to dark brown in color, and eggs are globular and vary from light yellowish green to dusky brown. This species is active throughout the year's life cycle and can be completed in about 30 days. It feeds on leaves, buds, and flowers of several vegetables and flowering plants as well as roses. They destroy seedlings, bore into lettuce heads and bean pods, and make deep watery cavities in fruits and leaves of ornamental plants i.e. ripening grapes, avocado, pear, plum, strawberries, rose, and zinnia (Teddy and Reddy, 1999).

6. Ladybugs (*Coccinella septempunctata)*

Lady bugs are also known as lady birds and lady beetles. Approximately 5000 different species, almost all ladybug species, have either dark spots or bands on their forewing. The most common species in the United States is the seven-spotted ladybug. Lady bugs inhabit grassy, riverine woody and urban environments. Some species of ladybug

were introduced to America and Europe and Asia for the protection of crops from aphids which are also found in rose plants and psylla scale insects and other several soft-bodied insects (Dey, 2015: Afzal and Ahmad, 2017). Morphologically the ladybugs have a head, promoting, forewing or elytra, and abdominal parts, and three pairs of legs are found in the body. This strategy ensures the larvae of lady beetles, which looks like a small spiky alligator has enough aphids to eat upon hatching. The complete metamorphosis of four stages of the life cycle (egg, larva, pupa, and adult) of a ladybug takes about 2 years to complete. An adult beetle can live up to one year. As larvae and adult ladybugs, beetles love to eat soft-shell insects and hundreds of aphids. It exists in roses that are images of agricultural and ornamental plants, orchards, and gardens (Kumar et al., 2023).

7. Leaf-cutting bee (*Megachile anthracina)*

This solitary bee builds its nest in hollow stems or pipers. It stuffs the with pieces of leaves that it cuts from several plants and uses this as food for its developing larvae. Roses are one of their preferred plants for cutting leaves. Adult beef cut semicircular holes in the Rose leaves usually affecting a few leaves of any other plant. These bees sometimes build their nest at the end of Garden hoses and gardeners discover when they turn on the water (Kumar and Kumaranag, 2018).

8. Thrips (*Rhipiphorothrips cruentatus*)

Thrips constitute one of the most important insect pests on ornamental plants as well as roses. There are so many species with flower thrips, but one of them species are defective and common trips are tiny, elongated insects about ⅙inches long when mature immature thrips are usually light yellow to Lemon colored and are spindle-shaped and leaves are required to be Precisely detect and identify them (Gahukar, 1999). Both adult and name stages cause damage by feeding on the flowers of Roses and other plants. They reduce the acetic value of the rose Bloom because feeding is often concentrated on any young actively growing tissue petals and leaves are often destructed or continue to expand after being damaged by thrips (Gahukar, 2003).

9. Jewel bugs (*Chrysocoris stolli)*

Due to the brilliant coloration, these insects feed on plant juice from a variety of different species including some commercial crops. Commonly known as green jewel bug, jewel bug, metallic shield bug, kitchen bug, and lychee shield bug. Order Hemiptera family Scutellerida eat as found in southeast Asia body is metallic green with a black spot over the pronotum and scutellum. Pronotum is with 8 black spots in the body, anterior margin, three larger and based on posterior margin. On the ventral side, purplish blue blade with green spots on the sternum, and the abdomen has brown or brownish yellow lateral margin pine or purple and stigma spots blade size of the body is 13.0 - 14.5 mm in length at a polyphagous insect feeding on several host juicy plants such as polyphagous. After long Martin the female lays about 23 May white spherical eggs in single or 2.5 batches. Nymph emergence takes within about a week. The bright green nymphs seem radish on emergence. Molt five times. The total life cycle completes in about a month (Husain and Dubey,

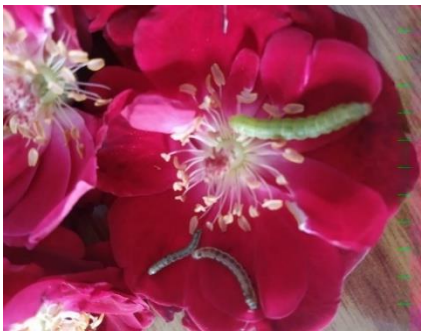
2021). Plague larvae infest several plants including their fruit very much reduced as a result of sucking their sap both by nymph larvae and adults (Kumar, 2013).

10. Spidermites (*Tetranychus cinnabarinus)*

Mites are not insects. Adult spider mites are so tiny that microscopes are required to see them. However, one can see them through a 10x hand lens also. Adults of most species are somewhat globular in shape and have eight legs. One of the more common species of spider mites is the two-spotted spider mite that has a dark spot on either side of the body. Adults and nymphs cause similar injuries. Feeding by low numbers of mites is inconsequential, but these pests have a high reproductive potential and can complete a generation in as little as seven days. Another mite species *Tetranychus urticae* is phytophagous and causes injury to roses and other tender parts. Rose gets infestation with spider mites *Tetranychus cinnabarinus*. Both nymphs and adults suck the sap from the lower sides of the leaves. Heavy infestations cause severe injury and even kill plants. Feeding by individual mites because of localized cell death, resulting in light-colored 'stippling.' Severely injured leaves may curl and drop from the plant. Initially, mite infestations are normally confined to the undersides of leaves, but under heavy infestations, the mites produce webbing. Because of this, the name spider mite has been accorded. Spider mites usually occur and colonize on the tops of leaves and other plant parts (Van *et al*., 2013).

Insects of Roses

Aphid
(*Macrosiphum rose)*



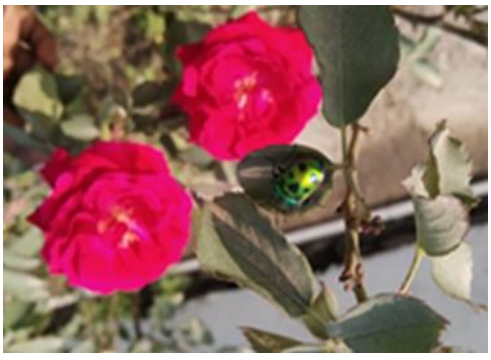
Tobacco caterpillar
(*Oxycetonia versicolor*)

Green lacewing
(*Chrysoperlo carnea*)

Chafer Beetle
(*Oxycetonia versicolor*)

Leaf-cutting bees
(*Megachile anthracina*)

Cornear warm
(*Helicoverpa zea*)



Jewel Bug
(*Chrysocoris stolli*)

Ladybird
(*Oenopia conglobata*)

Thrips
(*Rhipiphorothrips cruentatus*)

Spider mites
(*Tetranychus cinnabarinus*)

References

1. Afzal, M., and S. Ahmad. (2017). Biology and feeding potential of a ladybird beetle (Coccinella septempunctata) against different species of aphids. *Science International*, 29(6):1261-1263.
2. Ahmad, M; A. Ghaffar and M. Rafiq (2013). The host plant of leaf worm; *in Spodoptera litura (*Fabricius) (Lepidoptera: Noctuidae) in Pakistan. *Asian J. Agri Biol.* 1(1): 23-28.
3. Arya, S. (2015). Identification and controlling insects that prey on Roses with plant health care. Abstracts in the National Conference on Indian Botanical Garden organized by Botanic Garden. Floriculture and Landscaping Division CSIR-National Botanical Research Institute, Lucknow. pp. 71.
4. Arya, S. (2018). Biometrical Studies of Floribunda Roses. *International Journal of Biological Sciences 9*(1): 162-165.
5. Ashok, K.V. (2016). Biodiversity: Its Different Levels and Values. *International Journal on Environmental Sciences*. 7(2): 143-145.
6. Beerendra; P. Nagdev, J. Ganguli and A. Nag (2022). Biology of green lacewings chrysoperla species, (Neuroptera: Chrysopidae) fed on curry leaf psylla, Diaphorina citrine (Hemiptera: Liviidae). *The Pharma Innovation Journal of spe.*11 (5):05-07.
7. Dey, S.R. (2015) Ladybirds to the rescue: The aphidophagous ladybird beetle as a bio-control agent. The Beats of Natural Sciences, 2(3): 1-6.
8. Gahukar, R. T. (1999). New record of thrips attacking roses in central India. J. Insect Sci., 12(1), 89.
9. Gahukar, R.T (2003). Factors influencing thrips abundance and distribution on rose flowers in central India. *J. Entomol. Res*., 27(4), 271–179.
10. Husain, A. and A.K. Dubey (2021). New record of green jewel bug *Chrysocoris stolli* (Hemiptera: Scutelleridae) from Chhatarpur Madhya Pradesh (India)with its systematic account. Host plants and biological control. *International journal of global science research.* 8(1):1468-1472.
11. Kmic (2007). The occurrence of Macrosiphum rosae (L) (Hemiptera: Aphididae) on rose shrubs in Lubin. *Electronic journal of police Agriculture. University.* 10(2):23-25.
12. Kumar, A., Kumar, P., Aman, A. S., Mishra, P. K. and Kushwaha, D. (2023). Ladybird beetle (*Coccinella septempunctata* Linnaeus): *A*

Crucial Predator of Aphids. Vigyan Varta 4 (1): 25-28.

13. Kumar, P (2013). Biocontrol agent of chrysocoris stolli wolf (Heteroptera- pentatomidae) *Res. J. Pharm. biol. chem. sci. 4*(1):958-963.
14. Kumar. V and K.M. Kumaranag (2018). Diversity and conservation on leafcutter bees (Hymenoptera: Megachilidae). *Plants and Agricultural research.* 8(1):53-54.
15. Kumar; and R.P. Singh (2021). Population dynamics of *Spodoptera litura* Fabricius and their response with correlation meteorological factors in chili (Capsicum annum) crop. *Research Journal of Agricultural Science.*12 (3):1089-1092.
16. Leghari A.J., V.A. Laghari, A.H. Laghari, T.A. Bhutto (2016). Cultivation of rose (Rosa Indica L.). *Journal of Floriculture and Landscaping* 2:1-4.
17. Mehrparvar, M., M. Mobile and B. Hatami (2008). Seasonal population and fluctuation of aphids *Macrosiphum rosae* (L.) (Hemiptera: Aphididae) on different cultivars of Rose's and Nastaran. *Journal of Science and Technology of Agriculture Research and Natural Resources.* 12(45):711-719.
18. Naik, V.C.B., N.H. Giri and N. Kumar (2019). New report of *Oxycetonia versicolo*r Fabricius. as a pest of cotton from central India. National academy science litter. 42: 387-390.
19. Qadeer, A., Mouhammad, A., J. Ahmed and N. Suleman (2012). Effect of different photoperiods on the biological parameters of Chrysoperla carnea under laboratory conditions, *Journal of Basic and Applied Sciences*. 136(8):638-640.
20. Shanmugam, P.S., P. Sangeetha and M.R. Balamurali (2020). Damage of flower chafer beetle *Oxycetonia versicolor* Fabricius (Scarabidae Coleoptera) on Brinjal in Dharmapuri district, Tamil Nadu. *Journal of Entomology and Zoology studies.* 8(5):32-35.
21. Singh, R. and Agrawal, Ruhi (2022). Association of the Aphids (Insecta: Homoptera: Aphididae) with monocots flowering plants in India. International Journal of Biological Innovations. 4(2): 252-281.
22. Singh, R. and Singh, G. (2019). Species Diversity of Indian Aphids (Hemiptera: Aphididae). *International Journal of Biological Innovations.* 1(1): 23-29.
23. Singh, R. and Srivastava, A. (2022). An updated checklist of Aphids (Insecta: Homoptera: Aphididae) infesting plants of the orders Cornales and Ericales (Asterids: Eudicots: Angiosperms) in India. International Journal of Biological Innovations. 4(2): 349-367.
24. Singh, Rajendra and Singh, Garima (2022). Diversity of Aphids (Homoptera: Aphididae) infesting solanaceous plants (Angiospermae: Solanales: Solanaceae) in India. International Journal of

Biological Innovations. 4(1): 189-204.

25. Singh, Rajendra, Singh, Garima and Agrawal, Ruhi (2023). Association of aphids (Homoptera: Aphididae) with the flowering plants of nitrogen-fixing clade of fabids (Angiosperms: Eudicots) in India. International Journal of Biological Innovations. 5(1): 14-54.
26. Tauber,M.J.; C.A.Tauber,K.M. Daane, K.S.Hagen (2000). Commercialization of predators: recent lessons from green lacewings (Neuroptera: Chrysopidae: Chrysoperla). *American Entomology.46:*26-38.
27. Teddy M.R.S. and G.S. Reddy (1999). An eco-friendly method to control Helicoverpa armigera Hubner *Current science insect Environment* 4: 143-144.
28. Tyagi, S; A Lal and M.Pant (2020). Rose significance and potential of farming in hilly Areas. *An international Biological Peer Reviewed Refereed Research journal.*7 (28): 63-68.
29. Van T; Leeuwen, W. Dermauw, M. Grbic, L. Tirry, and R. Feyereisen, (2013).Spider mite control and resistance management: does a genome help. *Pest Management Science*. 69(2):156–159.
30. Verma, A.K. and Prakash, S. (2020). Status of Animal Phyla in different Kingdom Systems of Biological Classification. *International Journal of Biological Innovations.* 2 (2): 149-154.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 166 - 169|

Disasters and Anthropogenic Activities

Akshita Pandey
Department of Management
United Institute of Management, Prayagraj
Corresponding author: akshitapandey444@gmail.com

Abstract

The widespread and pervasive, debilitating after-effects of disasters needs no introduction. Since the Industrial revolution of 1850s, the quantum and intensity of disasters has increased manifold, thus creating huge political, socio-economic ramification. Huge drain of the precious and exhaustible resources of the world, in general and developing countries like India in particular, can create a vicious poverty trap for the marginalised and deprived section of the society thus creating huge pressure on the exchequer of the country. Food and supps, the exchequer negative change in the atmospheric patterns which includes wind patterns, ocean currents, global warming, ozone depletion etc. has the potential to stymie global economic development at its nascent stage and can pose existential crisis to the entire animal kingdom with mass extinction at the culmination. Most of the disasters have its origins in the human endeavour to play with the forces of nature in zest for development and materialistic pursuits thus creating natural force imbalance leading to disasters, hence the terminology man-made disasters or disasters caused due to anthropogenic activities. The study finds heightened relevance in our country on account of it having the potential to debilitate the structure of the world as we know it to shambles.

Keywords: Disasters, natural force imbalance, atmospheric patterns, geo-economic.

Introduction

With the onset of industrial revolution, technological advancement has permeated in every sphere of life and in zest for elevated economic development and materialistic pursuits by homo-sapiens, heightened human intervention with the forces of nature has become a new normal. Completely oblivious of delicate natural equilibrium attained over a span of 4.5 billion years by the planet, every facet of the environment is air, water or ground has come under salvo by relentless human bombardments in the name of infrastructure and development. Indigenous knowledge of the tribal that has maintained a syncretic relation with the nature for thousands of years has been put on the back burner. Hence the nature retaliates with the unleashing of its fury in the form of disasters which is manifested in earthquakes, tsunami, typhoons, drought, floods, landslides etc. Nuclear disasters, oil spills, industrial

disasters, forest fires are the ones which are apparent to have been caused by anthropogenic activities while other are one that can superficially be construed to be natural disasters but further probe reveals the role of humans behind it.

Need:

Mankind and entire plant and animal kingdom finds its origin and existence linked to nature and any adverse alteration in the delicate balance of the primordial forces of nature, thus creating disasters can have pervasive negative geo-political, economic and social ramifications [1]. Indiscriminate anthropogenic activities are one of the biggest disasters for good environment [2]. Besides obliterating the wheels of economic development, it can create existential threat to every known species of the planet that comes across its way, hence study of disasters primarily attributed to anthropogenic activities can help build strategies to alleviate its damages and further arrest the incidence, if possible, of it with the inculcation of innovative solutions which takes under it ambit, the consideration of the possible risk interactions [3]. The vast strides in the technology, spawning advancements in geospatial, geomorphological data synthesis and analysis can help devise optimal solutions for further arresting the quantum of the economic and human loss created by the disasters. The dissemination of knowledge related to disasters to be made available at the higher education level for the demography, particularly in vulnerable area, so as to make them aware of the disaster profiling data and subsequent strategies to be devised out to alleviate the debilitating after effects of the disasters [4].

The mitigation strategies become all the more imperative for an emerging economy like India as the disasters create havoc with widespread deprivation and subsequent decadence of the social, economic and political structure of the sovereign thus exacerbating the already stressed economic indicators of the demography of the emerging economy [5]. India is highly prone to disasters that can adversely impact the lives of the majority of the populace [6].

Scope:

It can help create strategies by international organizations, sovereign institutions such as NDMA that has played a pivotal role in devising strategies relevant to the disaster prone area taking into factor, risks involved, geological variables, severity of the probable disasters as well as non-state actors to further mitigate the debilitating after-effects of disasters and if possible to arrest the incidence of it[7].

With further probe and new data being brought to light thus improving on the previously available data relating to disasters incorporating various facets of its collection, analysis and synthesis eradicates redundancies and improves quality [8]. Enhanced knowledge of the working of the forces of nature can provide valuable insights which can go a long way in creating a mechanism that

can have least negative effects on the environment while ensuring global development, hence the path towards sustainable development. The sovereign institutions, such as, NDMA can play a pivotal role in dissemination of information related to disaster mitigation measures in a time bound manner hence creating resilient linkage in the chain of disaster mitigation strategies implementation by incorporating the involvement of the denizens at the planning and implementation level 9]. Enlightening still are the plethora of water conservation projects by the tribals that are in use even at present that has played a positive role in aquifers recharge, wetlands restoration etc. that touches the lives of billions of humans and animals alike that serves as a beacon of hope for the beleaguered nature [10].

Suggestions:

Creating an international organisation in line with the NDMA at the global level that can create global dissemination of the valuable insights and knowledge for the efficient pursuit of sustainable development to be carried out effectively at the grass-root level. Further a consolidated and streamlined set of guidelines to be devised out with inculcation of local variables for them to become more effective. The dissemination of knowledge related to disasters to be made available at the higher education level for the demography particularly in vulnerable domains to be made aware of the strategies to be devised out to alleviate the debilitating after effects of disasters.

Creating a global corpus in line with the carbon credit system that can ensure timely infusion of monetary help for the effective implementation of policies by sovereigns and non-state actors at the grass-root level of environment friendly technologies that can have a positive cascading effect on the environment at large.

Conclusion:

Disasters wreak havoc and throw the lives of those affected into complete dis-array. Homo sapiens despite making vast strides in the enhancement of standard of living and technology through the process of industrialisation and globalisation, has tilted the balance completely in favour of the destructive forces of nature, the manifestation of which is apparent in the form of disasters. Concerted effort by everyone has become the need of the hour to mitigate both the causes and devastating after effects of disasters. Initiatives like COP 21 of Copenhagen, Kyoto protocol, Montreal protocol has helped to create awareness about disasters and our role in the incidence of it, however the state of implementation of mitigation strategies at the grass-root level leaves much to be desired. Hence comprehensive probe and research on the anthropogenic activities role in the cause of disaster incident needs to be done.

References

1. McGuire, B., Maslin, M.A. (Eds.), 2012. Climate Forcing of Geological Hazards. Wiley Blackwell (311 pp.).

2. Prakash, S. and Verma, A.K. (2022). Anthropogenic activities and Biodiversity threats. International Journal of Biological Innovations. 4(1): 94-103.
3. Marzocchi, W., Garcia-Aristizabal, A., Gasparini, P., Mastellone, M.L., Di Ruocco, A., 2012. Basic principles of multi-risk assessment: a case study in Italy. Nat. Hazards 62 (2): 551–573. http://dx.doi.org/10.1007/s11069-012-0092-x.
4. Wachinger, G., Renn, O., Begg, C., Kuhlicke, C., 2013. The risk perception paradox—implications for governance and communication of natural hazards. Risk Anal. 33 (6):1049–1065. http://dx.doi.org/10.1111/j.1539-6924.2012.01942.x.
5. Enhancing Resilience to Extreme Climate Events: lessons from 2015-2016 El Nino event in Asia and Pacific ESCAP, UNDP,2017
6. Lea Berrang Ford (UK/Canada), Suruchi Bhadwal (India), Halvard Buhaug (Norway), Delavane Diaz (USA), Katja Frieler (Germany), Matthias Garschagen (Germany), Alexandre Magnan (France), Guy Midgley (South Africa), Alisher Mirzabaev (Uzbekistan/Germany), Adelle Thomas (Bahamas), Rachel Warren (UK), chapter sixteen of the IPCC Sixth assessment Report ,2022.
7. UNISDR, 2009. 2009 UNISDR terminology on disaster risk reduction. [online] Available at: http://www.unisdr.org/we/inform/terminology (accessed 04 January 2017).
8. Meyer, V., Becker, N., Markantonis, V., Schwarze, R., van den Bergh, J.C.J.M., Bouwer, L.M., Bubeck, P., Ciavola, P., Genovese, E., Green, C., Hallegatte, S., Kreibich, H., Lequeux, Q., Logar, I., Papyrakis, E., Pfurtscheller, C., Poussin, J., Przyluski, V., Thieken, A.H., Viavattene, C., 2013.
9. Annual report of NDMA 2020-2021.
10. Groundwater and its susceptibility to degradation: a global assessment of the problem and options for management. Early Warning and Assessment, Report Series, RS. 03-3. United Nations Environment Programme, Nairobi, Kenya (140 pp.). Mouflis, G.D., Gitas, I.Z., Iliadou, S., Mitri, G.H., 2008. Assessment of the visual impact of marble quarry expansion (1984–2000) on the landscape of Thasos Island, NE Greece. Landsc. Urban Plan. 86 (1):92–102. http://dx.doi.org/10.1016/j.landurbplan. 2007.12.009.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 170 - 177|

Role of Biotechnology in Environmental Sustainability

Shilpa Varma
Dr. B. Lal Institute of Biotechnology, Malviya Industrial Area, Jaipur (Rajasthan)
Corresponding author: rajasthanshilpavarma@drblal.com

Introduction:

Biotechnology is a tool for human welfare, according to Chambers *Science and* Technology Dictionary state that biotechnology as 'the use of organisms or their components in industrial or commercial processes, which can be aided by the techniques of genetic manipulation in developing e.g. novel plants for agriculture or industry.' Biotechnology is a rapidly evolving field that is continuously expanding its scope and potential to solve global challenges.

The term "Biotechnology" was first coined by Karl Rekey in 1991 implying the application of biological science and its interactions with man-made technologies. As in genetic engineering, with the spent of time biotechnology also involve in other fields such as environment or green remediation technology, use of plants and microbes for product production, in pharma (herbal drug extraction), agriculture, renewable energy sources, medical, forensic and food production. Biotechnology plays an important role to solve Environment related problems. Biotechnology is an efficient tool for find solution of environment sustainability like problems of plastics, waste water, sewage drain, heavy metal pollution and agriculture. In this chapter we will discuss how biotechnology plays a key factor in environment.

Biotechnology provides co-existence mechanism:

The environment is precious to human life and organisms. The sustainability means what nature gives us it will utilize and given back to nature with their terms and condition. Establishing an environmental-friendly co-existing mechanism on earth is crucial for the survival and sustainability of life on the planet. Human projects or venture have significantly impacted the environment, causing climate change, pollution, loss of biodiversity, and other environmental problems. These problems affect not only the natural environment but also the health and well-being of humans and other living organisms. To establish an environmental-friendly co-existing mechanism on earth, several steps can be taken, such as:

Adopting Green remediation technology practices:

A green remediation sustainability practice is an essential step towards use of techniques for environment welfare. It requires that resources are used as conservational and as optimally as possible in order to maintain an adequate

resource-base for future generations. Reducing carbon footprint, waste generation, and pollution by adopting sustainable practices such as recycling, energy conservation, and using eco-friendly products sustainable development can be achieved. Sustainability is neither an easy approach nor a providing instant result of adaptation. But according to today scenario it's an essential step towards save future.

Promoting renewable energy: Transitioning from fossil fuels to renewable energy sources such as solar, wind, and geothermal power can help reduce greenhouse gas emissions and mitigate climate change.

Conserving biodiversity:
Protecting and conserving natural habitats and biodiversity is essential for maintaining ecosystem services and ensuring the survival of species.

Creating awareness:
Raising public awareness about environmental issues and encouraging individuals and organizations to take responsibility for their environmental impact.

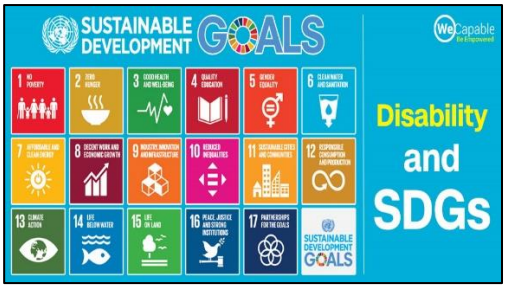
Regulating industries:
Implementing and enforcing regulations to limit the negative impact of industries on the environment.

Investing in research and innovation: Supporting research and development of technologies that can mitigate environmental problems and promote sustainable development.

By adopting these actions, we can establish a sustainable co-existing mechanism on earth that ensures the well-being of all living organisms and maintains a healthy planet for future generations.

According to current scenario human actions like 'ecological ogres' which could generate ecological disasters. The high rates of extinction of plant and animal species that are currently occurring are thus limiting biotechnological opportunities for the future.

The SDGs build on decades of work by countries and the UN, including the UN Department of Economic and Social Affairs The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries - developed and developing - in a global partnership



Role of Biotechnology in Agriculture sustainability:
The application of biotechnology provides profit and help to farmer, processor and consumer both in

implementation and in economic returns. Agriculture impacts on the national economy, the environment, as well as contributing to climate change. Farming and animal husbandry is essential to food production to fulfill the society hunger need. In the rapidly transforming change of biodiversity and ecological conditions, researchers have trying to provide suitable tool for sustainable agriculture.

The main problem is to find substitute for renewable resource in place of non-renewable sources. The substitute is also easy to use and cheap in cost are the other concerns in agriculture sustainability. However, there are many other research area in agriculture in which continuously research going for more advancement in concerned area.

Crop Improvement:
Biotechnology can help develop crops that are more resistant to pests, diseases, and environmental stress. This can reduce the need for harmful pesticides and fertilizers, which can contaminate soil and water.

Genetic Modification:
Genetic modification can help produce crops with enhanced nutritional content, longer shelf life, and improved yields.

Genomics and Proteomics in Agriculture Advances:
With crop and food bioengineering only at the beginning, the urge to clear the concept of fundamental genetic mechanisms of plants will only become more pressing.

Disease Management:
Biotechnology can be used to develop disease-resistant crops, reducing the impact of plant diseases on crop yields and quality.

Conservation of Biodiversity:
Biotechnology can contribute to the conservation of biodiversity by preserving endangered species through techniques such as cloning and genetic modification.

Bioremediation:
Biotechnology can help in the remediation of contaminated sites by using microorganisms to degrade pollutants in soil and water.

Precision Agriculture:
Biotechnology can contribute to precision agriculture by providing tools to monitor crops and soil, reducing the use of resources and increasing efficiency.

Sustainable Farming Practices:
Biotechnology can promote sustainable farming practices such as conservation tillage, crop rotation, and intercropping, reducing the need for chemicals and improving soil health.

Overall, biotechnology has the potential to play a vital role in promoting agricultural sustainability by developing crops that are more resistant to pests and diseases, reducing the use of harmful chemicals, improving soil health, and contributing to precision agriculture.

Role of Biotechnology in Waste Management:

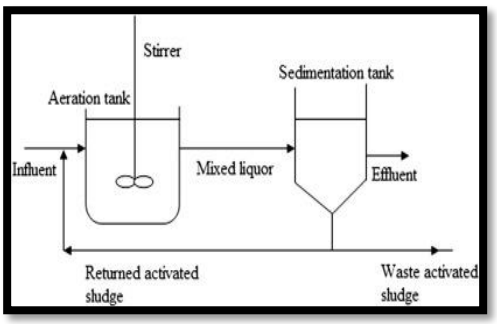
Biotechnology can help in waste management by breaking down organic matter into useful products such as compost, biogas, and biofuels. It can also be used to treat wastewater, reducing the environmental impact of sewage treatment.

It is universal acceptable that wastes generate as a result of human interaction and activities. However, there seems to be several opinions as to what constitute a waste. Several opinion are there for waste material like those material are not used by someone or no longer needed would considered to be "waste". There are several source of waste generation like households, agriculture, industries and others. Based on source waste produce would be categorized at biodegradable and non-biodegradable. The hazardous effect on environment should also be considered. Hence there is need of proper waste management Programme which involves end to end solution or a process whereby wastes are collected, transported and disposed of in the best possible way of limiting or eliminating the harmful effect of wastes. Since, reserach have shown a direct link between air, water and land pollution and diseases such as lung cancer, heart disease, cholera and hepatitis. In addition, climate change and eutrophication are a direct result of water and air pollution. Little wonder why there is a huge disparity in the life expectancy of people in developed and developing countries. To fulfil the gap of waste management and make it to more easy biotechnology introduce a technology like

Activated sludge:

The activated sludge procedure is one of the most commonly used for secondary wastewater treatment. As a suspended-growth biological treatment process, activated sludge utilizes a dense microbial culture in suspension to biodegrade organic material under aerobic conditions and forms a biological floc for solid separation in the settling units. Diffused or mechanical aeration maintains the aerobic environment in the reactor.

An activated sludge wastewater treatment system has at least four components; an aeration tank, a settling tank (clarifier), a return sludge pump and a system of introducing oxygen into the aeration tank.



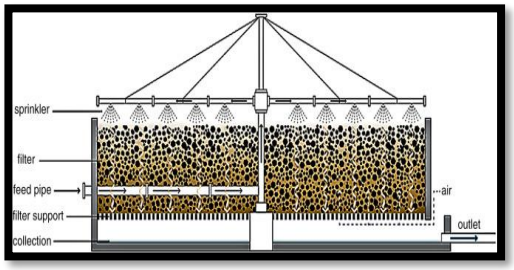
Source:https://www.sciencedirect.com/topics/engineering/activated-sludge

Trickling filter:

A trickling filter is a bed of high-surface-area material, such as shredded plastic or rock, on which microorganisms grow to form a biofilm.

The microorganisms break down organic material in wastewater through aerobic

metabolism, resulting in water and carbon dioxide. Wastewater is sprayed over the biofilm, and as it trickles downward, the microorganisms further purify it, removing about 85% of organic matter. Trickling filters are also known as bio filters or biological filters.



Source: https://www.sciencedirect.com/topics/earth-and-planetary-sciences/trickling-filter

Bioreactor:

Bioreactor is widely used for municipal and industrial wastewater treatment. A packed bed bioreactor is a fixed bed that supports the attachment of microorganisms, widely used in wastewater treatment. The sequencing batch process operates in four steps: feed, react, settle, and decant. Settling requires more time and reactor volume depending on biofilm growth and settles ability. The operational mode can be programmed to achieve anaerobic, aerobic, or anoxic treatment based on wastewater characteristics and degree of treatment required. High-rate anaerobic reactors treat industrial wastewater with organic loading rates as high as 10-15 kg m−3 d−1. A hybrid system of the UASB (Up flow anaerobic sludge blanket) reactor and an internally packed bed bioreactor can enhance the UASB reactor's performance

Composting and Vermicompost:

Composting is a dynamic and rapid biological process that involves controlled oxidation of organic matter followed by maturation through microbial populations. The process results in a stable humus-like product (compost) that is hygienic and free of unpleasant characteristics. During composting, microorganisms biodegrade organic matter in the presence of oxygen, converting 20-30% of the volatile solids into CO_2 and H_2O. The resulting stabilized organic residuals, microbial biomass, CO_2, water, and heat are used to produce a nutrient-rich fertilizer. Organic Microorganisms+ Biodegradable + O_2 Stabilized organic residuals + Microbial biomass $+CO_2+H_2O$ + Heat.

Vermicomposting is a process of composting organic waste using earthworms. In this process, earthworms consume organic waste and excrete nutrient-rich castings, which are a highly effective natural fertilizer. The process is faster than traditional composting methods and results in higher quality compost. Vermicomposting can be done in small, indoor spaces and is a great way to reduce food waste and other organic waste while producing a valuable soil amendment. It is an eco-friendly method of waste management that can be done on a small scale at home or on a larger scale for commercial purposes. Some common types of earthworms used in vermicomposting include red wigglers and European

nightcrawlers. The end product of vermicomposting, vermicompost, is high in beneficial microorganisms, plant growth hormones, and nutrients like nitrogen, phosphorus, and potassium.

Role of biotechnology in Phytoremediation:

Phytoremediation uses plants to remove contaminants from the soil or water. Plants absorb contaminants through their roots, and the contaminants are either stored in the plant tissue or broken down into less harmful compounds.

Phytoremediation is a sustainable and cost-effective process that uses plants and microbes to remediate or stabilize the environment from various pollutants. Plants can hyper accumulate different heavy metals and sequester toxicants to manage harmful pollutants. Biotechnology plays a crucial role in enhancing plant resistance to contaminants, and genetically modified plants and microbes can be used for efficient phytoremediation. Wastewater treatment is also possible through biotechnological approaches, and certain plant-microbe interactions can promote phytoremediation. The chapter focuses on advancing plant competency and phytoremediation potentiality through biotechnological practices to address future challenges.

Chemical oxidation:

Chemical oxidation is a remediation technique that uses oxidizing agents to break down organic contaminants into less harmful substances. It is commonly used to treat groundwater contaminated with organic pollutants such as petroleum hydrocarbons, chlorinated solvents, and pesticides.

During chemical oxidation, the oxidizing agent, such as hydrogen peroxide, ozone, or permanganate, reacts with the organic contaminants to form stable or less harmful compounds, such as carbon dioxide, water, and inorganic salts. The process may also generate heat and gases, depending on the type of oxidant used.

Chemical oxidation can be performed in situ, which involves injecting the oxidant directly into the contaminated groundwater or soil, or ex situ, which involves excavating the contaminated soil and treating it above ground. In situ treatment is generally more cost-effective and less disruptive than ex situ treatment, but it requires careful planning and monitoring to ensure that the oxidant is distributed evenly and does not migrate to uncontaminated areas. Overall, chemical oxidation is an effective and versatile remediation technique that can be used alone or in combination with other technologies to treat a wide range of organic contaminants.

Conclusion:

In conclusion, biotechnology has an important role to play in promoting environmental sustainability. Biotechnology based solutions, such as phytoremediation and genetically modified organisms, can help to remediate contaminated environments and mitigate the impact of pollution. Biotechnology can also be used to enhance agricultural productivity, reduce

food waste, and develop sustainable biofuels and biomaterials. However, as with any technology, biotechnology also poses some risks and challenges. For example, the release of genetically modified organisms into the environment can have unintended consequences, and the long-term effects of some biotechnology-based solutions are not yet fully understood. Therefore, it is important to carefully evaluate the potential risks and benefits of biotechnology-based solutions and to ensure that they are used in a responsible and sustainable manner. Overall, biotechnology offers great potential for promoting environmental sustainability, but it must be used in a way that balances economic, social, and environmental concerns. By continuing to develop and refine biotechnology-based solutions, we can create a more sustainable future for ourselves and for the planet.

Bibliography:

1. Adhena Ayaliew Werkneh and Eldon R. Rene Applications of Nanotechnology and Biotechnology for Sustainable Water and Wastewater Treatment Springer Nature Singapore Pte Ltd. 2019 X.-T. Bui et al. (eds.), Water and Wastewater Treatment Technologies, Energy, Environment, and Sustainability, https://doi.org/10.1007/978-981-13-3259-3_19 *Editors: V. Kumar, G. Singh and N. Aggarwal © 2017 Nova Science Publishers, Inc.* ISSN 1538-2273 ©2011 Academic Journals
2. *Antoinette M. Mannion; Sustainable Development and Biotechnology; Environmental Conservation, Volume 19, Issue 4 , Winter 1992 , pp. 297 – 306 DOI: https://doi.org/10.1017/S0376892900031416*
3. Charcosset C (2006). Membrane processes in biotechnology: An overview. Biotechnol. Adv. 24: 482-492.
4. Cheremisinoff, N. P. (2003). Handbook of solid waste management and waste minimization technologies [electronic resource]. Oxford: Butterworth-Heinemann
5. Ebikapade Amasuomo1 & Jim Baird1 The Concept of Waste and Waste Management Journal of Management and Sustainability; Published by Canadian Center of Science and Education Vol. 6, No. 4; 2016 ISSN 1925-4725 E-ISSN 1925-4733
6. Hanife Buyukgungor and Levent Gurel, The role of biotechnology on the treatment of wastes African Journal of Biotechnology Vol. 8 (25), pp. 7253-7262, 29 December, 2009 Available online at http://www.academicjournals.org/AJB ISSN 1684–5315 © 2009 Academic Journals
7. *International Society of Environmental Biotechnology (2018) http://www.iseb-web.org/. Accessed 22 July 2018*

8. John Cary, Trevor Webb1 and Neil Barr2The adoption of sustainable practices: Some new insights An analysis of drivers and constraints for the adoption of sustainable practices derived from research, *July 2001 Department of fisheries, agriculture and forestry in Australia.*

9. Kavamura VN, Esposito E (2010) Biotechnological strategies applied to the decontamination of soils polluted with heavy metals. Biotechnol Adv 28(1):61–69

10. Lange, CC; Wackett, LP; Minton, KW; Daly, MJ. Engineering a recombinant Deinococcus radiodurans for organopollutant degradation in radioactive mixed waste environments. Nature Biotechnology. 1998, 16, 929-933**.**

11. Ngoc, U. N., & Schnitzer, H. (2009). Sustainable solutions for solid waste management in Southeast Asian countries. Waste Management, 29(6), 1982-1995 https://doi.org/10.1016/j.wasman.2008.08.031

12. Pankaj Kumar, Ajay Kumar Thakur-(2021) *Crop Improvement, Biotechnological Advances;* First Published2021 eBook Published 30 June 2021 Pub. Location Boca Raton Imprint CRC Press; https://doi.org/10.1201/9781003099079;Pages270; eBook; ISBN-9781003099079; Subjects Bioscience, Environment & Agriculture

13. Parker SP, Corbilt RA (1992). Mc Gram-Hill Encyclopedia of environmental Science and Engineering 3rd Edition, McGraw-Hill, Inc. pp. 210-211, 541-595, 675-678.

14. Sajjad Ghahari, Somayeh Ghahari, Saeid Ghahari, Ghorban Ali Nematzadeh & Hemen Sarma, *Environmental Biotechnology: Toward a Sustainable Future,Chapter Biotechnology for Sustainable Environment pp 1–3*

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 178 - 188|

Water and Wastewater Treatment Technologies

Chandra Bali Patel[1] and Anand Prakash Singh[2*]

[1]Department of Botany, Rashtriya Kisan (PG) College, Shamli (U.P.)

[2]Department of Botany, Bipin Bihari College, Jhansi (U.P.)

Corresponding author: anandbotany@gmail.com

Abstract

The life originated in water between 3.5 and 4 billion years ago. The initial life was jumbled and prokaryotic in nature followed by eukaryotic system. Whatever may be the form of life but water always remains the integral part of life. This water contains many organic and inorganic nutrients either in soluble or insoluble forms which are necessary for the survival for the aquatic flora. Increasing the nutritional content in water made the water bodies eutrophic and lead to exponential growth of microorganisms and biofilm formation and made water bodies polluted. On the other hand domestic wastes, industrial effluents, agricultural runoff and other non-point sources of pollution which contain faecal matters, organic wastes, inorganic minerals, heavy metals and other types of pollutants made the water reservoirs extremely polluted. Increasing world population is demanding more supply of fresh and pristine water. This demand couldbe fulfilled by the treatment of wastewater and supply of this treated water again for the consumption purposes.

***Keywords*:** Coliforms, Faecal Coliforms, Pathogens, Wastewater, Non-point Sources.

1. Introduction

The global distribution of water (in volume km^3) can be summarised as: oceans contain 1 322 000000km^3, polar ice caps and glaciers constitute 29 200 000 km^3, exchangeable ground water 24 000 000 km^3, freshwater lakes 125 000 km^3, saline lakes and inland seas 104 000 km^3, soil and subsoil water 65 000 km^3, atmospheric vapour 14 000 km^3, rivers and streams 1 2000 km^3, whereas the annual inputs by rainfall on ocean 412 000 000 km^3 and rainfall on land and lakes 108 000 00 km^3(Horne and Goldman, 1994). Most the water present in oceans (more than 96 percent) and remaining less than four percent within continental territories including polar ice-caps and non-polar water. Non-polar surface freshwater includes soil water, lakes, rivers and streams.

First forms of life were originated in water. Water will always remain the integral part of life; rather there is no life without water. Today, more than ever, this critical resource is stressed by multiple and sometimes competing demands such as for human consumption, agriculture, industry, recreation, electricity generation, and ecosystem requirements. The

contamination of water systems by pathogenic organisms frequently occurs in both developing and developed countries across the globe (Herwaldt*et al.,* 1992; Moore *et al.,* 1994; Zuckerman *et al.,* 1997; Howe *et al.,* 2002; Belkin and Colwell, 2006).Diarrhoeal diseases kill an estimated 1.8 million people each year (WHO, 2005),which accounts for 17% of deaths of children fewer than 5 years of age in developing countries (United Nations 2006). Ninety-four percent of this disease burden is attributable to the environment, including risks associated with unsafe water, lack of sanitation and poor hygiene (Prüss-Üstün and Corvalán, 2006). Although, water supplies in piped-in system are an important long-term goal, the world health organization (WHO) and United Nations Children's Fund (UNICEF) acknowledge that it is unlikely to meet the ***Millennium Development Goals*** (MDG) target of halving the proportion of people without sustainable access to safe drinking water and basic sanitation by 2015. As a result, alternative interventions are being sought that can deliver the health gains of safe drinking water at lower cost. Amongst the candidate alternatives, conventional source and a variety of household-based water treatment interventions are important (WHO, 2008). The infectious agents, mostly associated with diarrhoeal diseases are transmitted mainly through the fecal oral route (Black 2001). The conventional interventions to improve water supplies at the source (point of distribution) have long been recognized as effective means for in preventing diarrhoea (Esrey, 1985, 1991), more recent reports have shown household-based (point-of-use) interventions to be significantly more effective than those at the source (Fewtrell 2005; Clasen 2006). As a result, there is increasing interest in such household-based interventions. The occurrence of pathogens and indicator organisms in groundwater and surface water sources depends on a number of factors, including intrinsic physical and chemical characteristics of the catchment area. Further, the magnitude and range of human activities and animal sources that release pathogens into the environment through their faecal matter play a critical role.

In surface waters, potential pathogen sources include point sources such as municipal sewerage and urban storm water overflows, as well as non-point sources such as contaminated run-off from agricultural areas and areas with sanitation through onsite septic systems containing faecal matters. Other sources are wildlife and direct access of livestock to surface water bodies. Many populations of pathogens in surface water bodies are reduced due to dilution, settling and die-off due to environmental effects such as thermal, solar light, predation, etc.

Rivers are the most precious and easily accessible reservoir of fresh water and are vulnerable to a wide range of biological and non-biological contaminations resulting due to anthropogenic and natural processes. The rivers in developing as well as in developed countries have become

reservoir of antimicrobial-resistant pathogens due to inappropriate use of antimicrobials in human and animal husbandry medicine (Ahmed *et al.*, 2005). The consumption of unsafe water leads to elevated DALYs (Disability Adjusted Life Years). DALY is a measure of the health of the population; one DALY represents one year of healthy life lost, proceeding towards the increased rate of morbidity and mortality (WHO, 2002; Hamner *et al.*, 2006). A report from UNDP-World Bank (2002) depicts that about 80% children suffer from water-borne diseases every year and millions of lives are lost annually due to water-borne diseases in India (Brandon, 1995). A number of reports exist on the water-borne outbreaks in the last decade in India which is summarized in Table 1. Further, as mentioned earlier more than seven lakhs children of age group less than five years die annually from diarrhoea in India (Johnson and Lvovsky, 2001).

Presently, most of the Indian rivers and their tributaries are polluted due to drainage of about 500-million litres sewage, solid wastes and industrial effluents per day from more than two hundred macro cities. Only 10% of wastes are treated prior to discharge into the rivers (Department of Atomic Energy, 2005). Central Pollution Control Board (CPCB) India, reports that the bacterial contamination due to discharge of untreated domestic and industrial wastes from urban areas of the country has become critical for water bodies. The inflow of water to the water bodies are less as compared to the need of water to dilute the pollutants and the bacterial population that lead to eutrophication and increase in the burden of microbial population in rivers and this gives rise to water-borne diseases (CPCB, 2005). Recreational activities, holy dips and daily bath expose millions of people to microbial contamination along the river landscape (Karn and Harada, 2001; Hamner *et al.*, 2006; Hamner *et al.*, 2007; Servais, 2007). The increasing outbreaks of illness in recent years may be due to the frequent exposure of public to water resources that are contaminated with disease causing microorganisms originating from human and animal fecal matters (Figure 1 and 2). Hence, there is an urgent need for continuous assessment and monitoring of the water quality of the rivers. However, many of the pathogens cannot be directly detected. And water bodies often contain several types of pathogens, but making enumeration of each pathogen is impractical and not easy (U.S. EPA, 2001). Therefore, the water quality criteria are based on detection of 'indicator' organisms such as fecal coliforms that, if present in high densities, have been shown to be associated with an elevated risk of illness (Cabelli*et al.*, 1982; 1983; Dufour, 1984).

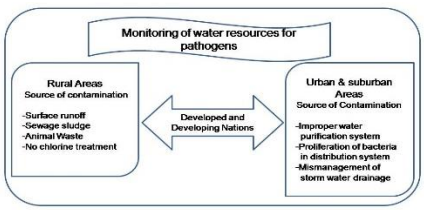


Figure 1. Factors affecting river water quality across the globe.

2. Microbial indicators

The use of bacteria as indicators of sanitary quality was started from 1880 by the description of Von Fritsch that *Klebsiella pneumoniae* and *K. rhinoscleromatis*as micro-organisms characteristically found in human feces (Geldreich 1978). These microorganisms are used for the prediction of the potential risk associated with pathogenic microorganisms.

Indicator microorganisms are useful in the sense that they outwit the need to assay for every pathogen that may be present in water (Scott *et al.,* 2002). An increasing number or concentration of faecal coliforms provides an indication of microbial contamination of water bodies and also potential health risk. Besides faecal coliforms, other organisms that serve as indicators of microbial contamination and potential health risk include *Enterococcus*, *Escherichia coli*, *Streptococcus* (faecal streptococci), and total coliforms. Coliforms usually are sparsely concentrated in most habitats (soil and vegetation) except faecal waste. However, in faecal waste they are highly concentrated. Therefore, the presence of coliforms is considered to be an indicator of faecal contamination. More than 60% of total coliforms are faecal coliforms, and more than 90% of the faecal coliforms are members of the genus *Escherichia*. These organisms share good qualities of indicator organisms. The quality of good indicators should be in large numbers with faecal waste, easy to count, and identify. Ideally, indicators should be non-pathogenic; rapidly detectable, easily enumerable, should have survival characteristics that are similar to those of the pathogens of concern, and can be strongly associated with the presence of pathogenic microorganisms (Scott *et al.,* 2002).

2.1 Bacterial Source Tracking:

A source of the impairment must be identified for a polluted water body that needs to be identified in order to implement the Total Maximum Daily Load (TMDL) plan. The selection of bacterial source tracking (BST) method depends on available resources, scope of project, and target organism(s). BST methods generally fall into three categories: Genotypic (dealing with the genetic makeup of an organism), phenotypic (observable characteristics of an organism) and chemical. Molecular methods tend to be more costly requiring highly trained personnel with expensive equipment. The phenotypic methods allow a higher throughput of samples, a quicker turn around, and less skilled personnel. Chemical methods fall somewhere in between mainly because of equipment costs.

2.2 Point Source of Pollution:

The known and identified source of pollution is referred as point source of pollution. Point source includes municipal sewage treatment plant discharges, household wastes and industrial discharges. Municipal sewage treatment plant point sources discharge the effluents which remain oxygen devoid and may lead to serious health

risks. Industrial effluents are composition of several hazardous chemical and biological components depending on the types of industry. The industrial effluents are very hazardous to water reservoirs and ultimately for human health too.

2.3 Non-Point Source of Pollution:

Faecal pathogens in water reservoirs are hazardous to public health due to water contact recreation and ingestion of contaminated foods. The dominant source of FC is from nonpoint sources, which is discharged over the entire length of a river. The possible introductions of FC to the land surfaces are through the manure spreading process, direct deposition from livestock during the grazing season, and excretions from pets and wildlife (USEPA, 2001). As runoff occurs during rain events, surface runoff transports water and FC over the land surface. The deposition of non-human FC directly to the shellfish harvesting areas occurs when livestock or wildlife have direct access to the water body. Non-point source contributions from human activities arise from failing septic systems and their associated drain as well as through pollution from recreational vessel discharges. The transport of FC from the land surface to the shellfish harvesting area is dictated by the hydrological cycle, soil type, land use, and topography of the watershed. To provide the basis for States to establish a water quality based pollution control, the development of FC in TMDL has been mandated to establish the allowable loads for the FC that a water body can receive without exceeding water quality standards (USEPA, 2001).Point and non-point sources of pollution have been described in figure 2.

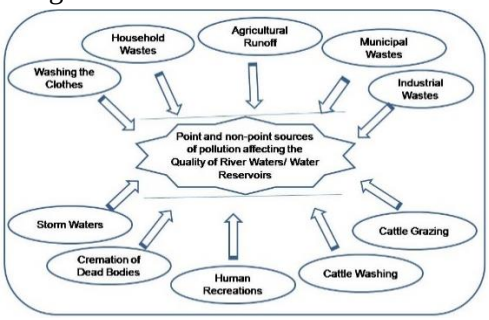


Figure 2. Point and non-point sources of pollution affecting the quality of river waters and other water reservoirs.

2.4 Total Coliforms:

The total coliform group belongs to the family Enterobacteriaceae and includes the aerobic and facultative anaerobic, Gram-negative, non-spore-forming, rod-shaped bacteria that ferment lactose with gas production within 48 hours at 35^0C (APHA, 1998). They develop red colonies with a metallic (golden) sheen within 24 hours at 35°C on an Endo-type medium containing lactose. All total coliform bacteria possess the enzyme β-galactosidase, which cleaves a chromogenic substrate (e.g. *ortho*-nitrophenyl-β-D-galactopyranoside), resulting in release of a chromogen (*ortho*-nitrophenol) (APHA, 1998). These bacteria are useful in determining the quality of potable water, shellfish-harvesting waters, and recreational waters. However, they are less sensitive than viruses or protozoan cysts to environmental factors and to

disinfection. Some members (e.g., *Klebsiella*) of this group may sometimes grow under environmental conditions of industrial and agricultural wastes. Some members of total coliform bacteria are of fecal origin while others are of non-fecal origin.

2.5 Faecal Coliforms

Faecal coliforms or thermotolerant coliforms include all coliforms that can ferment lactose at 44.5^0C. The faecal coliform group comprises bacteria namely *Escherichia coli, Enterobacter, Klebsiella,* and *Citrobacter.* These coliforms are discharged in high numbers ($2x10^9$ coliforms/day/capita) in human and animal faces, but not all of them are of faecal origin. These indicators are useful for determining the quality of potable water, shellfish-harvesting waters, and recreational waters. The presence of faecal coliforms indicates the presence of faecal material from warm-blooded animals. However, human and animal sources of contamination cannot be differentiated. Some investigators have suggested the sole use of *E. coli* as an indicator of faecal pollution as it can be easily distinguished from the other members of the faecal coliform group (e.g., absence of urease and presence of β-glucuronidase). Further, it has been reported that a value of total coliform in an environmental sample consist of *E. coli, Citrobacter, Enterobacter* and *Klebsiella* spp. (*E. coli: Citrobacter/ Enterobacter: Klebsiella* spp.; 94:4:2) where *E. coli* contributes 94% to the total coliform value of in an environmental sample (Dufour, 1977; Leclerc *et al*., 2001). Faecal coliforms display a survival pattern similar to that of bacterial pathogens. They may also re-grow in water and waste-water under appropriate conditions. The distinction between human and animal sources of *E. coli* may be accomplished by using methods such as antibiotic resistance patterns or DNA fingerprinting.

3. Wastewater Treatment

Waste water management is one of the most challenging tasks of present time when sources of fresh water are deteriorating with accelerated rate. The wastewater carries domestic and industrial sewage, industrial effluents, agricultural runoff, urban runoff and other nonpoint sources of pollutants (Table1). These waters mainly contain organic matters, inorganic minerals and nutrients along with particulate matters.

Table 1: Common contaminant of wastewater

Contaminants	Problems associated with contaminants
Suspended	Depletion of sludge leading to anoxic conditions on dischargement into aquatic system
Biodegradable organic compounds	These include proteins, fats and carbohydrates when discharged into water and increase its nutritional components to enhance heterotrophic growth and anoxic conditions
Pathogenic Microorganisms	These pathogenic microorganisms cause infectious diseases
Prime Pollutants	Include organic and inorganic compounds that may be toxic, carcinogenic, mutagenic and other hazardous causes
Refractory Organic compounds	Organic compounds such as phenols surfactants, agricultural pesticides
Heavy metals	The industrial effluents discharged into water bodies and these are toxic to all trophic levels
Dissolved inorganic Constituents	These includes calcium, sodium, and sulphate that may be added to domestic water supplies and these are essential to remove before reuse

Source: Adopted and modified from Prescott Microbiology, 8th edition 2011.

3.1 Parameters of Water Quality:

Various parameters are taken into consideration when the water quality is measured such as total organic carbon (TOC), biochemical oxygen demand (BOD), chemical oxygen demand (COD) and oxygen contents. The total organic carbon may be defined as all the carbon content in the water whether it is utilised by the microorganisms or unused. The organic matters on oxidation converted into carbon dioxide at elevated temperature in presence of oxygen. The chemical oxygen demand is almost similar measurement with a few exceptions like lignin. The biological oxygen demand is the measure of oxygen content in the water or wastewater required to oxidize the carbon content by microorganisms at 20^{o}C for the duration of five days.

3.2 Wastewater Treatment Techniques:

Now a days more emphases are given on the treatment and recycling of wastewater (Figure 3). There are three major steps in the wastewater treatment called as primary, secondary and tertiary treatment.

3.2.1 Primary Treatment:

In primary treatment the heavy and insoluble material gets settled down or screened by physical process or by the addition of alums and other coagulating agents in the tanks or basin. The resulted material is usually called sludge.

3.2.2 Secondary Treatment:

The secondary treatment is more or less biological process in which biological transformation of dissolved organic matters into microbial biomass and CO_2. The effluents before secondary treatment have high biochemical oxygen demand due to presence carbon content but after secondary treatment it reduces by more than 90 percent. In this process numbers of pathogenic bacteria are removed. In this treatment after sufficient growth of microorganisms they aggregate and form stable flocs settle down. This is crucial stage with regard that if the O_2 content is low and microbial community is very new or very old then massive growth of filamentous bacteria develops which leads to poor and unsettling flocs formation and ultimately leading to low quality of final effluents.

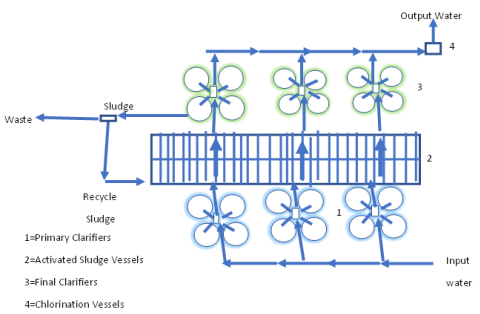


Figure 3. Diagram of Sewage Treatment Plant (Diagrammatic).

The aerobic activated sludge system is the process in which the sludge is mixed with actively growing microorganisms. It may be low-rate system or high-rate system depending on the basis nutrient inputs per unit biomass of microorganisms. In aerobic secondary treatment a trickling filter is applied in which the waste effluent is passed over rock or other solid objects upon which the microbial biofilms develop and

degrade the organic wastes and produce carbon dioxide. The amount of sludge can be reduced by applying extended aeration process. The aerobic secondary treatment requires large aeration basin and long aeration time. The aerobic treatment produces excess of microbial biomass or sewage sludge which contain many complex organic maters. The sludge settled in primary treatment are further treated by anaerobic digestion.

In anaerobic digestion continuous supply of untreated sludge are entered and treated and stabilized sludge are produced. Anaerobic digestion carried out by anaerobic microorganisms and involved three sequential reactions namely fermentation producing organic acids; acetogenic reactions produce acetate, hydrogen and CO_2; and methanogenic reaction produce methane. Methanogenesis is energetically quite inefficient process hence huge amount of sludge are consumed to produce methane.

3.2.3 Tertiary Treatment:

Tertiary treatment involved for further treatment of wastewaters to remove nitrogen and phosphorus in the form of gaseous nitrogen and phosphate (in the form of calcium or iron phosphate), polyphosphate respectively to check eutrophication. In this process many heavy metals, remaining microbes and viruses are also removed. Phosphorus is removed by alternate oxic and anoxic conditions. Nitrogen is removed by denitrification process in which nitrate is reduced to N_2 and N_2O. Another process called anammox in which ammonium ion react with nitrite to produce nitrogen gas. Tertiary treatment is an expensive process.

4. Conclusion: Increasing global population and decreasing reservoirs of fresh water have put the serious burden over the nations to supply fresh and pristine water. Several measures are applied to restore the reservoirs of fresh water unpolluted but it is insufficient to meet the task of water demand. So new and non-conventional methods are under more trial to provide fresh water. Wastewater treatment techniques and plants are in operation at present time at every small and big city to fulfil the demand of fresh water. And much more are still required to be done.

References

1. Ahmed, W., Neller, R. and Katouli, M., Host species-specific metabolic fingerprint database for *Enterococci* and *Escherichia coli* and its application to identify sources of fecal contamination in surface waters, Appl Environ Microbio, 71, 4461-4468, 2005.
2. APHA (American Public Health Association), Standard Methods for the examination of water and wastewater, 18th edition, American Public Health Association, Washington, D.C. 1998.
3. Belkin, S., and Colwell, R. R., eds., 2005 Oceans and Health: Pathogens in the marine environment, Springer, New York 464p.
4. Black, R.E., 2001. Diarrheal diseases, in Nelson KE, Masters

Williams C, Graham N, *Infectious Disease Epidemiology: Theory and Practice*. Gaithersburg, MD: Aspen Publisher, Inc.

5. Brandon, H., The Cost of Inaction: Valuing the Economy-wide Cost of Environmental Degradation in India, World Bank Report, World Bank, New York, 1995.
6. Cabelli, V. J., P., D. A., McCabe, L. J. and Levin, M. A., A marine recreational water quality criterion consistent with indicator concepts and risk analysis. J Water Pollut Control Fed, 55, 1306- 314, 1983.
7. Cabelli, V. J., Dufour, A. P., McCabe, L. J. and Levin, M. A., Swimming-associated gastroenteritis and water quality, Am J Epidemiol, 115, 606-616, 1982.
8. Central Pollution Control Board, National Water Quality Monitoring at a Glance, http://cpcbenvis.nic.in/wq-2005/watmain2005.htm, 2005.
9. Clasen, T., Roberts, I., Rabie, T., Schmidt, W. and Cairncross, S., Interventions to improve water quality for preventing diarrhea, (A Cochrane Review), In: The Cochrane Library, Issue 3, 2006.
10. DAE (Department of Atomic Energy), Govt. of India, Radiation technology for urban sludge hygienisation, In: Environment-Technologies for better quality of life, 2005.
11. Dufour, A. P., Bacterial indicators of recreational water quality, Can J Public Health, 75, 49-56, 1984.
12. Dufour, A. P., Escherichia coli: the fecal coliform. In: Hoadley, A. W., Dutka, N.J. (Eds.), Bacterial Indicators/Health Hazards Associated with Water, Am Soc Test Mater, Philadelphia, 48–58, 1977
13. Esrey, S. A., Feachem, R. G. and Hughes, J. M., Interventions for the control of diarrhoeal diseases among young children: improving water supplies and excreta disposal facilities, Bull WHO63, 4, 757-772, 1985.
14. Fewtrell, L., Kaufmann, R., Kay, D., Enanoria, W., Haller, L. and Colford, J., Water, sanitation, and hygiene interventions to reduce diarrhoea in less developed countries: a systematic review and meta-analysis, Lancet Infect Dis, 5, 42-52, 2005
15. Geldreich, E. E., Bacterial populations and indicator concepts in feces, sewage, stormwater and solid wastes. In Indicators of Viruses in Water and Food (ed. G. Berg), Ann Arbor Science, MI, 51–97, 1978.
16. Herwaldt, B. L., Craun, G. F., Stokes, S. L., and Juranek, D. D., Outbreaks of waterborne disease in the United States: 1989-90, J Amer Water Works Assoc, 64, 4, 129-135, 1992.
17. Horne, A.J. and C.R. Goldman. Limnology. 2nd edition. McGraw-Hill Co., New York, 1994.
18. Howe, A. D., Forster, S., Marshall, R., Osborn, K. S., and Wright, P.,

*Cryptosporidium*oocysts in a water supply associated with Cryptosporidiosis outbreaks, Emerg Infect Dis,**8** (6), 619-624, 2002.

19. Johnson, I. and Lvovsky, K., Indoor Air Pollution: Energy and health for the poor, World Bank Special: Double Burden-World Bank/ESMAP Newsletter, Issue No. 1, September 2000 Issue No. 3, 2001.
20. Karn, S. K. and Harada, H., River water pollution in three urban territories of Nepal, India, and Bangladesh, Environ Manage, 28, 483-496, 2001.
21. Leclerc, H., Mossel, D. A., Edberg, S. C. and Struijk, C. B., Advances in the bacteriology of the coliform group: their suitability as markers of microbial water safety, Annu Rev Microbiol, 55, 201-234, 2001.
22. Moore, A. C., Herwaldt, B. L., Craun, G. F., Calderon, R. L., Highsmith, A. K., and Juranek D. D., Waterborne disease in the United States: 1991-1992, J. Amer. Water Works Assoc, 86, 87-99, 1994.
23. Nataro, J. P. and Kaper, J. B., Diarrhoeagenic *Escherichia coli*, *Clin Microbiol Rev*, 11, 142-201, 1998.
24. Nataro, J. P., Enteroaggregative *Escherichia coli* pathogenesis, Curr Opin Gastroenterol,21, 4-8. 2005.
25. Prescott Microbiology, 8th edition 2011.
26. Prüss-Üstün, A. and Corvalán, C., Preventing disease through healthy environments: toward an estimate of the environmental burden of disease. Geneva: The World Health Organization, 2006
27. Servais, P., Garcia-Armisen, T., George, I., and Billen, G., Fecal bacteria in the rivers of the Seine drainage network (France): sources, fate and modelling, Sci Total Environ, 375, 152-167, 2007.
28. Scott, T. M., Rose, J. B., Jenkins, T. M., Farrah, S. R. and Lukasik, J., Microbial source tracking: current methodology and future directions, Appl Environ Microbiol, 68, 5796-5803, 2002.
29. Sletvold, H., Johnsen, P. J., Simonsen, G. S., Aasnaes, B., Sundsfjord, A. and Nielsen, K. M., Comparative DNA analysis of two vanA plasmids from Enterococcus faecium strains isolated from poultry and a poultry farmer in Norway, Antimicrob Agents Chemother, 51, 736-739, 2007.
30. UNDP-World Bank: Water for India's poor: Who pays the price for broken promises? UNDP-World Bank Water and Sanitation Program Report: South Asia Region Report, 2002.
31. U.S. EPA: Elements of a State Water Monitoring and Assessment Program*:* Publication EPA-841-B-03-003*;* Washington, DC, 2003.
32. U.S. EPA: Protocol for Developing Pathogen TMDLs, EPA 841-R-00-002, Office of Water (4503F), United States Environmental

Protection Agency, Washington, DC, 2001.
33. World Health Organization. World Health ReportGeneva: World Health Organization,2008.
34. World Health Organization. World Health ReportGeneva: World Health Organization,2005.
35. World Health Organization. World Health ReportGeneva: World Health Organization,2002.
36. Zuckerman, U., Gold, D., Shelef, G. and Arnon, R., The presence of *Giardia* and *Cryptosporidium* in surface water and effluents in Israel, Water Sci Technol, 25,381-384, 1997.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 189 - 197|

Impact of Climate Change in Indo-Gangetic Plain on Food Security of Indian Society

***[1]Upendra Goyal, and [2]Dr. Dinesh Singh Kushwah**

[1]Department of Sociology, Jiwaji University, Gwalior (M.P.)

[2]Department of Sociology, Madhav College, Jiwaji University, Gwalior (M.P.)

*Corresponding author: upendragoyal8@gmail.com

Abstract

The Indo-Gangetic Plains (IGP) are characterized by main cereal-based food-producing regions of India spread across the states of Punjab, Haryana, Uttar Pradesh, Bihar & West Bengal. Cereal crops (mainly rice & wheat) are crucial to ensuring the food security in the India, but sustaining their productivity has become a major challenge due to climate variability & uncertainty. This paper uses an integrated model to make an integrated assessment of climate change in this region and provides an overview of the impact of climate change in this region on food security of Indian society.

Keywords: IGP - Indo-Gangetic Plains, Food Security, Climate Change, Food Insecurity

Introduction:

The Indo-Gangetic Plain, also known as the Indus-Ganga Plain or the North Indian River Plain, is a vast and densely populated region and it encompasses most of northern and eastern India (See Fig 01). The IGP is formed by the alluvial deposits of the Indus, Ganges, and Brahmaputra rivers, covering an area of over 2.5 million sq. km. which flow through the region and bring rich sediment from the Himalayas (Rowley 1996). The plain is known for its fertile soil and abundant water resources, which support agriculture and human settlement. It is one of the world's most fertile agricultural regions and is also known for its unique cultural, historical, and ecological significance. However, the region also faces significant environmental challenges, such as increase in average temperatures, groundwater depletion, water pollution, soil degradation and flooding, particularly during the monsoon season, which can cause widespread damage to crops and infrastructure, as well as social and economic issues related to food security, poverty, urbanization and inequality. In the past the earth's climate changed due to natural reasons (Ruddiman and Kutzbach, 1989; Ruddiman, 2001) but the present cause of global warming is, in part, manmade due to the increased concentration of carbon dioxide in the atmosphere (IPCC, 2014).

A major concern stands emphasized further after the release of the fifth assessment reports of the

Intergovernmental Panel on Climate Change (IPCC), released in 2014. The report noted that IGP region is particularly vulnerable to climate change due to its high population density, dependence on agriculture and limited adaptive capacity. The region is expected to experience a wide range of impacts, including changes in temperature and precipitation patterns, increased frequency & intensity of extreme weather events and sea level rise. In the Indo-Gangetic Plain specifically, these impacts are expected to have significant effects on agriculture, which is the primary source of livelihood for many people in the region. Changes in temperature and precipitation patterns could lead to decreased crop yields and reducing soil fertility, while increased frequency and intensity of extreme weather events could cause flooding & damage to infrastructure. This can result in food shortages and economic losses for the India. At the heart of the Sustainable Development Goals (SDGs) are targets to end hunger, achieve food security and improve nutrition. For India, food security continues to be high on its list of development priorities because the country's relatively high rates of economic growth have not led to a reduction in hunger and under nutrition. As this paper shows IGP is one of the main cereal crops-production regions in India. With climate change lower agriculture productivity raising major concerns for food security of Indian society.

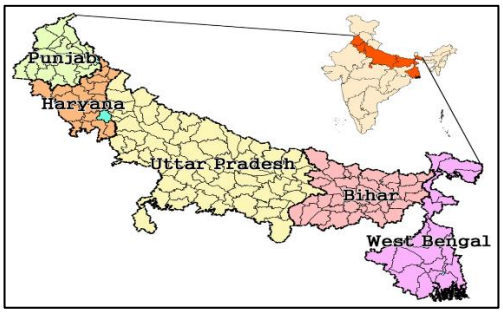


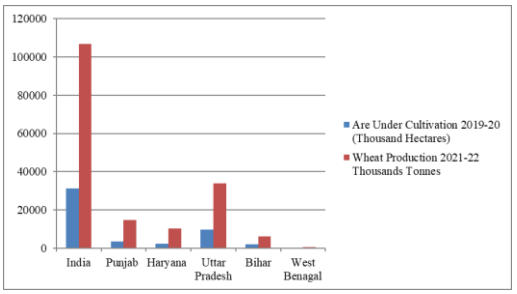
Fig 01: The Indo-Gangetic Plains of India showing state & district boundaries

Significance of Indo-Gangetic Plain in Food Security of Indian Society:

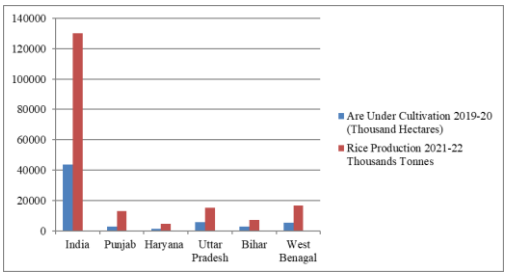
The Indo-Gangetic Plain, also known as the "breadbasket" of India, plays a crucial role in ensuring the food security of the country. The region is home to several major river systems, including the Ganges, Brahmaputra, and Indus, which provide ample water for irrigation and crop production. The region has a diverse range of soil types, which allows for the cultivation of a wide variety of crops (Saini *et al*.,2001). The region is particularly important for the production of rice & wheat, which are the staple foods of much of the Indian population. The IGP's contribution to India's food security can be gauged from the fact that it produces more than 60% of the country's wheat & rice production (Graph 01 & 02). The region's agricultural productivity has helped to make India self-sufficient in food production, reducing the country's dependence on imports & ensuring that the population has access to affordable food.

Overall, the Indo-Gangetic Plain is critical to India's food security, as it provides a significant portion of the

country's food supply and supports the livelihoods of millions of farmers. The region's continued agricultural productivity is essential to ensuring that India can meet the food needs of its growing population in the years to come.



Graph 01 : Wheat Cultivation Area & Wheat Production Of States In Indo- Gangetic Plain & India.



Graph 02: Rice Cultivation Area & Rice Production f States in Indo- Gangetic Plain & India

Methodology:

The historical data for a period of 50 years (1951-2009) on meteorological parameters, temperature and average rainfall for both kharif & rabi season were collected from the various secondary sources for the districts in the Indo-Gagnetic plain. The historical data was analyzed on seasonal (kharif & rabi) basis by calculating rate of change in maximum & minimum temperatures in between 1951 to 2009 for districts of the IGP for both seasons. The rainfall data was collected from the various secondary sources for the different districts of the IGP (as per the data availability) and they were analyzed on seasonal (kharif & rabi) basis by calculating frequency and severity of high and low rainfall events for both seasons.

Impact Of Climate Change in Indo-Gangetic Plain:

Climate change is expected to have significant impacts on the region, including:

1. **Increased temperatures:** The region is already known for its hot and humid climate (Timsina and Connor 2001). Since the pre-industrial period, the land surface air temperature has risen sharply as compare to the global average temperature in this region. The region has been experiencing a steady increase in average temperatures due to climate change. According to the Indian Meteorological Department, the average temperature in the region has already increased by around 0.7°C over the past century.

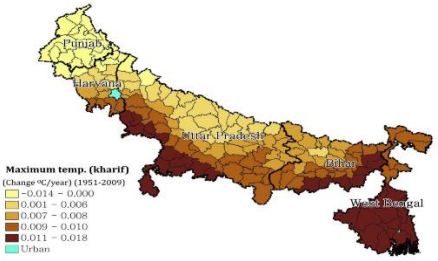


Fig 02: Maximum Temp. (kharif) Change (oC/ Year) 1951-2009 For Districts of Indo-Gangetic Plain in India.

Warming has resulted in an increased frequency, intensity & duration of heat-related events, including heat waves in this region. However, with global temperatures rising, the region is likely to experience even higher temperatures, leading to increased heat waves & associated health problems.

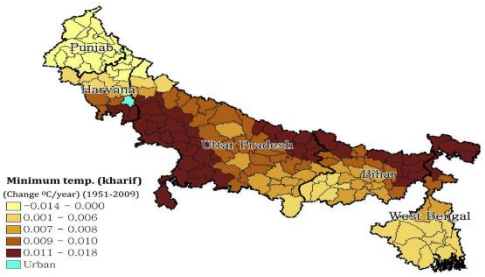


Fig 03 : Minimum Temp. (kharif) Change (oC/ Year) 1951-2009 For Districts of Indo-Gangetic Plain in India

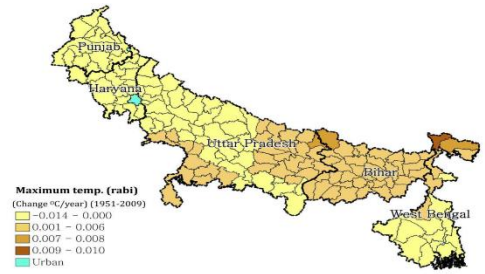


Fig 04: Maximum Temp. (rabi) Change (°C/ Year) 1951-2009 For Districts of Indo-Gangetic Plain in India.

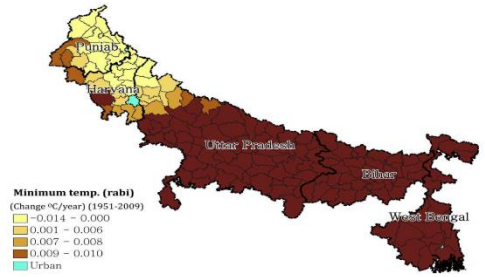


Fig 05: Minimum Temp. (rabi) Change (°C/ Year) 1951-2009 For Districts of Indo-Gangetic Plain in India.

Figures 2 to 5 show the pattern of rate of change of maximum and minimum temperatures for kharif & rabi seasons in all the districts of the IGP. The rate of change of maximum temperature for the kharif season was high in southern Uttar Pradesh, southern Bihar & almost entire West Bengal. On the other hand, the rate of change of minimum temperature was high in south-western and upper UP, northern Bihar and northern West Bengal during kharif season. The rest of UP & Bihar had almost similar patterns of rate of change in maximum & minimum temperatures during kharif season. Punjab and Haryana showed the lowest rate of change for both maximum and minimum temperatures during kharif season.

The rate of change of maximum temperature in rabi season was low, which ranged from -0.014 to 0.010 for the entire IGP (Fig. 4). The rate of change of minimum temperature was high, ranging from -0.015 to 0.032 in almost the entire UP, Bihar and West Bengal. The rate of change of maximum temperature decreased as one moves towards the northern & western parts of the IGP. Punjab and Haryana again showed a very low rate of change of minimum temperature for the rabi season. The region is projected to experience a continued increase in average temperatures, with some studies suggesting that temperatures could rise by up to 4-5°C by the end of the century.

1. Water scarcity:

Water scarcity is a growing concern in the Indo-Gangetic Plain due to a combination of factors, including population growth, climate change and poor water management practices.

One of the main sources of freshwater in the region is groundwater, which is rapidly depleting due to over-extraction. Many farmers rely on groundwater for irrigation, & the increasing demand for water is leading to the depletion of aquifers & major concern in areas where the groundwater is not being recharged, leading to a permanent loss of water resources. In addition, surface water resources in the region are also under pressure due to pollution & mismanagement. Rivers which are essential for the region's economy and environment, are under threat from climate change and pollution. The IGP relies heavily on the monsoon season and on the waters from major river systems of Yamuna, Ganga, Sutlej, Indus, Kosi, Ravi etc for irrigation & agricultural production. The IGP has two drainage basins: the western part contains plains of Punjab & Haryana, and the eastern part comprises the Ganges-Brahmaputra drainage systems.

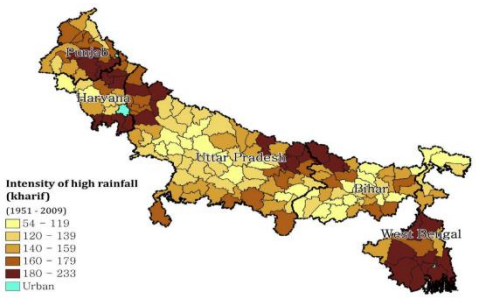


Fig 06: Intensity of high rainfall (kharif) 1951-2009 For Districts of Indo- Gangetic Plain in India.

The plains of Punjab & Haryana are irrigated using waters from the rivers Ravi, Beas and Sutlej. The middle Ganges extend from the Yamuna River in the west to the state of West Bengal in the east (Kumar et al., 1996).

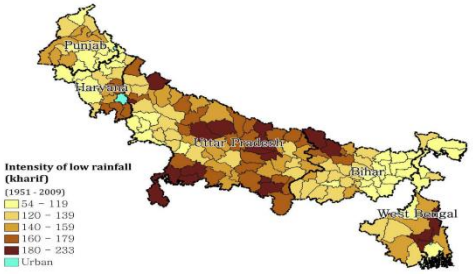


Fig 07: Intensity of low rainfall (kharif) 1951-2009 For Districts of Indo- Gangetic Plain in India

The IGPR receives, on an average, annual rainfall of 150 cm (east) & 50 cm (west). Climate change is expected to alter the timing & intensity of monsoon rains, leading to water scarcity and to more frequent and severe drought conditions.

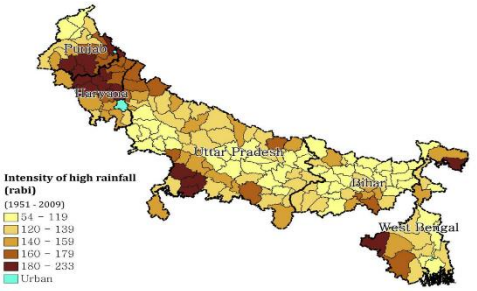


Fig 08: Intensity of high rainfall (rabi) 1951-2009 For Districts of Indo- Gangetic Plain in India

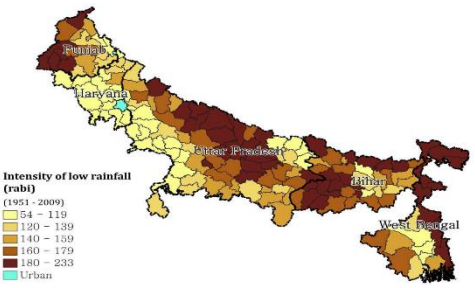


Fig 09 : Intensity of low rainfall (rabi) 1951-2009 For Districts Of Indo- Gangetic Plain In India

Figures 6 to 9 show the index of intensity of low & high rainfall during khari & rabi seasons in all the districts of States in the IGP. The higher the value of the intensity index, higher is the seasonal rainfall variability. The intensity of low rainfall in kharif season was higher in the central part of the IGP comprising the districts of central & eastern UP & a couple of districts of Haryana & Bihar. The rest of UP, Haryana & West Bengal had low to moderate intensity of low rainfall during kharif season, ranging between 160-180. The rest of the study area showed a very low intensity of low rainfall, less than 120 in kharif season. On the other hand, the intensity of high rainfall in kharif season varied in the opposite manner. The western part of IGP comprising Punjab, Haryana & southern parts of West Bengal showed higher intensity of high rainfall during kharif season. The central part of the IGP had a relatively lower intensity of high rainfall during kharif season & almost the entire Bihar had the lowest intensity of high rainfall during kharif season with index value less than 120.

The distribution of intensity of low rainfall during rabi season was similar to that of the kharif season (Fig. 9). The central part of the IGP, northern & western Bihar, eastern West Bengal & a couple of districts in western Punjab showed higher intensity of low rainfall during rabi season with index value above 180. Haryana & south-western UP had the lowest intensity of low rainfall during rabi season with values less than 120. Intensity of high rainfall during rabi season was higher in the districts on the border of Punjab & Haryana. A couple of districts in southern UP & West Bengal also showed higher intensity of high rainfall during rabi season. The remaining study area had a relatively lower intensity of high rainfall during rabi season with index value less than 140.

The projections for precipitation are more uncertain, with some studies suggesting that the region could experience increased rainfall, while others suggest a decrease. However, there is a general consensus that extreme rainfall events are likely to become more frequent, which can lead to flooding & landslides.

1. **Glacial melting**

The melting of glaciers in the Himalayas has a significant impact on the Indo-Gangetic Plain, which is downstream of these glaciers. The Himalayan glaciers serve as a critical source of freshwater for the region, and as they melt, it can lead to both short-term and long-term impacts. In the short term, the melting of glaciers can lead to increased flooding in the region. As the glaciers melt, they release large volumes of water, which can lead to flash floods & landslides. These events can be catastrophic, causing loss of life and damage to infrastructure, including homes, roads & crops.

In the long term, the melting of glaciers can lead to reduced water availability in the region. The melting of glaciers is one of the main sources of freshwater for many rivers in the region, including the Ganges, Indus and Brahmaputra. As these glaciers melt, the volume of water in these rivers will decrease, leading to water scarcity in downstream areas. The reduced availability of freshwater can have significant impacts on the region's agriculture, it can lead to lower crop yields and reduced agricultural productivity, resulting in economic losses for farmers and food shortages for the population.

2. **Rising sea levels**

The Indo-Gangetic Plain is located at a low elevation and is vulnerable to sea-level rise. The region's coastal areas are also at risk from sea-level rise, which can lead to increased flooding, erosion and loss of land, affecting agriculture and settlements.

3. **Air pollution**

The IGP is particularly susceptible to air pollution, which is exacerbated by climate change. The region experiences high levels of air pollution due to factors such as industrial activity, transportation & agricultural practices. Climate change is expected to exacerbate this problem by increasing the frequency and intensity of dust storms and other weather phenomena that can worsen air quality.

Impact of Climate Change In IGP 0n Food Security of Indian Society:

Agriculture production of IGP is highly vulnerable to climate change largely because By 2050 at least 50% of Indo-Gangetic plain which is a ideal low-rainfall, irrigated and temperate region will become heat-stressed, short season area. The effect of climate change on the IGP region will primarily be by the glacier melting impacts & heat waves and extreme climates. Droughts & floods due to climate change also have a greater impact on agriculture production of this area. The impact of climate change on water availability will be particularly severe for IGP because large parts of the IGPR already suffer from water scarcity, to begin with, and largely depend on groundwater for irrigation. north-western India, notably the states of Punjab & Haryana, which account for the bulk of the country’s rice and wheat output, are extremely water-stressed.

A significant rise in mean temperature is observed in both the rice & wheat -growing periods. Rainfall during the rice-growing period has decreased 7% annually over the past 30 years. Temperature extremes caused a considerable wheat yield reduction In IGP, the wheat yield loss for every 1°C rise in temperature was estimated to be 4 to 5 million tones. In IGP region, delay in the harvest of rice crop resulted in the late sowing of wheat & this led to wheat yield loss due to the high temperature at grain filling stage.

Moreover, warmer temperatures can lead to the earlier flowering and maturity of wheat plants, which can reduce grain yield and quality & as rice is a water-intensive crop, and water scarcity due to droughts can significantly impact rice production.

The current temperature rise has reduced the wheat yields up to 5 percent. The future weather predictions of the IGP region show that wheat farming may not be suitable in this region due to heat stress. It is estimated that increase in global mean temperature by one degree-Celsius would reduce global wheat yield of by 6 percent, the annual mean temperature of India will rise by 1.5 - 3°C & this could have a damaging effect on the future wheat cultivation.

Studies have shown that by the year 2050, wheat yields in the region could decrease by up to 50% and rice yields in the region could decrease by up to 15% due to the impacts of climate change.

Conclusion:

The impacts of climate change on wheat & rice production in the IGP can have significant implications for food security in Indian society. Reduced yields and crop failure can lead to food shortages, price increases & economic losses for farmers. Moreover, food shortages can also lead to malnutrition, especially among vulnerable populations such as children & pregnant women.

It is crucial to take action to adapt to these impacts through measures such as promoting the use of drought-resistant crops, improving water management & developing pest and disease-resistant crops. Additionally, reducing greenhouse gas emissions to mitigate the impacts of climate change is critical to preventing further exacerbation of these impacts in the region.

References

1. Pathak, H., Ladha JK, Aggarwal PK, Peng S, Das S, Yadvinder Singh, B?ay-Singh, Kamra SK, Mishra B, Sastri ASRAS, Aggarwal HP, Das DK and Gupta RK. (2003) Climatic potential and on-farm yield trends of rice and wheat in the Indo- Gangetic Plains. Field Crops Res. 80(3):223-234.
2. Pathak H and Aggarwal PK (Eds.) (2012) Low carbon technologies for agriculture: A study on rice and wheat production systems in the Indo-Gangetic Plains. Indian Agricultural Research Institute, New Delhi. p. xvii + 78.
3. Timsina J and Connor DJ (2001) Productivity and management of rice-wheat cropping systems: issues and challenges. Field Crops Res. 69: 93-132.
4. Wentz, F.J., Ricciardulli, L., Hilburn, K. and Mears, C. (2007) How much more rain will global warming bring? Science, v. 10, pp.1126.
5. Sharma, S, Joachimski, M, Sharma, M. Tobschall, H.J., Singh, I.B., Sharma, C., Chauhan, M.S. and Morgenroth, G. (2004) Late glacial and Holocene environmental changes in Ganga plain, Northern India. Quat. Sci. Rev., v. 23, pp.145-159.
6. Shukla, U.K., Singh, I.B., Sharma, M. and Sharma, S. (2001) A model of alluvial megafan sedimentation: Ganga Magafan. Sedimentary Geology, v. 144, pp. 243-262.

ENVIRONMENT AND SOCIETY 2022

ISBN: 978-81-954002- 7-0 | Year: 2023 | pp: 197 - 205|

Diabetes Mellitus and its remedies by Indian Herbal Medicines

Kunjlata Lal
Department of Education
Ranchi Women's College, Ranchi University, Ranchi (Jharkhand)
Corresponding author: kunjlata_lal@yahoo.co.in

Introduction

Diabetes Mellitus**,** also known as type 2 diabetes mellitus, which is a chronic disease or a metabolic disorder which happens due to increased level of blood glucose or blood sugar. It causes significant damage to the blood vessels, heart, kidney and nerves. The high blood sugar immediately stimulates a cluster of special cells which is called Beta cells; from the Pancreas and it release insulin. If more glucose is reported in blood then more insulin from Pancreas is released. Thus, Insulin helps in balancing blood glucose level. The condition in which excess glucose is found in blood stream is called Hyperglycaemia and insulin encourages the storage of glucose as glycogenin the liver, muscles and fat cells. These Glycogen can be used later when we have energy requirement in the body, while in stress or in between meals etc. As a result, there is less insulin in blood stream and the normal blood glucose level is restored [1]. Insulin effect several other areas of the body also which includes the synthesis of lipids and the regulation of enzymatic activities. It also stimulates the synthesis of glycogen in Liver and when the liver is saturated with glycogen, an alternative pathway takes over, which involves the uptake of the additional glucose to adipose tissue which leads to the synthesis of lipo-proteins.

If hypoglycaemia is not treated for a long period, there is damage of nerves, blood vessels, tissues and organs. The damage of blood vessels can increase the risk of heart attack and stroke. The nerve damage can lead to eye damage, kidney damage, gum damage and even foot damage and non-healing wounds [2, 3]. Although diabetes has no cure still we can manage it and stay healthy. The prolong usage of synthetic drugs may cause side effects like mental illness or other physiological imbalance in the body. A new approach for treatment of this disease can be by natural supplements as Plant sources consists of different natural anti-oxidants such as Tannins, Flavonoids, Alkaloids, Quercetin etc, that have the ability to maintain β-cells which decreases glucose levels in the blood, which acts against defective cellular metabolism and regulates its functional properties. Plants based medicines have no side effects as medicinal plants contains many active bio-compounds [4,5].

Indian Medicinal Plants and its anti-diabetes properties:

Medicinal plants and its products continue to be an important therapeutic aid for alleviating the ailments of human

kind [6,7]. Herbs for diabetes treatment are not new, since ancient times, plants and plant extract were used to combat diabetes. Many traditional medicines in use are derived from medicinal plants, minerals and organic matter. Natural products are known to play an important role in pharmaceutical biology [8]. According to World Health Organization (WHO), 90% of the population in India uses plants and its parts for health care.

The most common anti-diabetic medicinal plants in India are Neem (*Azadirachta indica*), Karela (*Momordica charantia*), Onion (*Allium cepa*), Garlic (*Allium sativum*) and Aloe-vera (*Aloe barbadensis*).

Neem (*Azadirachta indica*):

Neem (*Azadirachta indica*) is medicinal plants have been scientifically explored for their anti-diabetic and antioxidant activities. [8-14] The biological activities of neem tree is reported in different parts of neem leaf, bark, seed and oil. The neem leaf is an effective remedy for treating diabetes as they are loaded with –Flavonoids, triterpenoid, anti-viral compounds and Glycosides, which may help manage blood sugar levels. Neem is also known as "Store house" of a number of phytochemicals. More than 300 phytochemicals were extracted from neem tree [15-17].

The two most important classes of phytochemicals which have been isolated from various parts of neem are isoprenoids and non-isoprenoids. The most widely recognised isoprenoids include diterpenoids, vilasinins, triterpenoids compounds, limonoids and C-secomeliacins while proteins, carbohydrates (polysaccharides), sulphur compounds, tannins, polyphenolics such as flavonoids and their glycosides, dihydrochalcone, coumarin and aliphatic compounds, phenolic acid comes under non-isoprenoids. Other phytochemicals derived from neem are nimbolide, azadirachtin, azadiradione. gedunin and azadirone [21].

Several studies have revealed that the anti-diabetic properties of neem leave aid insulin to increase the uptake of glucose into fat and muscle cells and hence, help in maintaining glucose levels in the body. Neem leaves are loaded with flavonoids, triterpenoid, anti-viral compounds and glycosides, which may help manage blood sugar levels and ensure there is no sugar in glucose. Neem leaves are also rich in certain active compounds and contains antioxidants, all these possess anti-inflammatory, anti-microbial, anti-diabetic and wound healing properties.

Neem leaves should be eaten in an empty stomach early in the morning or before meals, once or twice a day for effective control of diabetes and also for weight loss.

Risk of over-consumption

In some cases, it is observed that overconsumption of neem leaves may cause blood sugar level to go too low, which is very dangerous, to avoid this it is always best to monitor the blood glucose level.

Making Neem Powder and Neem Juice

A Diabetes patient is always recommended bitter food to regulate their blood sugar level.

Neem Powder:

Its making is easy. We take some dried neem leaves and grind them in a blender until it becomes smooth. This neem powder can be consumed twice daily for optimum benefits.

Neem juice:

1. At least 20-25 neem leaves is boiled for 5 minutes in half a litre of water.
2. We observe that the leaves become soft in appearance and the colour changed to deep green.
3. We then stain and store this water in a container,
4. It is recommended, that the diabetic patient should drink this juice twice daily for optimum benefits. Neem is also rich in Vitamins A and C which are amazing antioxidants. They regulate insulin release and manage blood sugar levels. Calcium present in the plant helps in reducing muscle and joint pains in diabetic patients. It also helps them develop strong bones. Iron deficiency can put the patient at a greater risk of diabetes and neem is an abundant source of iron. All these properties together make neem a great herb for diabetic patients.

Karela (*Momordica charantia*):

Momordica charantia (Karela) is worldwide cultivated which has magical powers to treat a wide variety of diseases. *Momordica charantia* has significant anti-diabetic as well as hypolipidemic activity so that it can be used as an adjuvant along with other treatment to treat diabetes as well as to delay the late complications of diabetes. As *Momordica charantia* (Karela) is bitter in taste, it regulates the digestion and metabolism, cures fever, jaundice, anaemia etc., It is an antioxidant, hypoglycaemic activity (lowers the blood sugar level), anti- bacterial property (kills bacteria), anti-viral properties (kills virus), anti-cancer property, anti- diarrheal effects. The main constituents of Karela are: triterpene, protein, steroid, alkaloid, inorganic lipid and phenolic compounds [22].

Bioactive compounds present in bitter gourd (Karela). The primary metabolites in Karela are common sugar, protiens and chlorophyll while secondary metabolites are phenolics, carotenoids, curcubitane triterpenoids, alkaloids, saponins etc. Secondary metabolites are responsible for the nutraceuticals properties of karela which scarcely contribute to the nutritional value but produce beneficial physiological effect in the body [30]. Karela contains a few chemicals including glycoside, charatin, vicine, karavilosides and pllypeptide-p (plant insulin). These chemicals might improve blood sugar levels by raising the glucose uptake and synthesisof glycogen in the liver, fat and muscles cells [23].

Nutritional Values of Karela:

Momordica charantia (Karela) has following important nutrients [24]:

Nutrient	Amount per 100 g
Potassium	296 mg
Copper	0.034 mg
Zinc	0.8 mg
Selenium	0.2 µg
Manganese	0.089 mg
Vitamin A	24 µg
Vitamin B1 (Thiamine)	0.04 mg
Vitamin B2 (Riboflavin)	0.04 mg
Vitamin B3 (Niacin)	0.4 mg
Vitamin B5(Pantothenic acid)	0.212 mg
Vitamin B6	0.043 mg
Vitamin B9 (Folate)	72 µg
Vitamin C	84 mg

Advantages of Karela for Diabetes:

Karela has a compound that functions similar to insulin and is known as p-insulin which regulates blood sugar level. Karela reduces the blood glucose levels in both types of diabetes (Diabetes I & II). Karela helps regulate blood sugar level in body by activating insulin level. Making the insulin active helps maintain blood sugar and prevents its conversion into fat. Charant in present in karela has a blood sugar- lowering effects. Consuming a glass of karela juice is very effective and the patients need to reduce the dosage of their medicines. The best time to drink karela juice is in the morning on an empty stomach. This helps to regulate the blood sugar level and it does not lead to any sudden spikes. In some cases it is observed that consumption of Karela may cause blood sugar levels to go too low, which is very dangerous, if consumed with certain medicines, to avoid this it is always best to monitor the blood glucose level. Karela should not be consumed when taking insulin injection.

Karela juice:

Mix a cup of Karela with ½ cup of water. Blend until smooth and strain the mixture. Add lemon juice and salt as per your taste. Pour in a small glass and drink right away.

Onion (*Allium cepa*):

Onion (*Allium cepa)* is grown world-wide with characteristics pungent resulting from the sulphur-rich volatile oil which it contains and the release of this oil during peeling or chopping brings tears in the eyes. Onions (*Allium cepa)* are high in vitamin C and are a good source of dietary fibres and Folic Acid. They have calcium, iron, and a high protein quality. It is low in sodium and has no fats. It contains Quercetin, a flavonoid (an anti-oxidant compound). It also contains organosulfur, which may offer unique health benefits.

Onions (*Allium cepa)* are nutrient-dense, they are low in calories but high in vitamins and minerals. Vitamin C acts as a powerful antioxidant in our body, protecting our cells against damage caused by unstable molecules called free radicals. Onions (*Allium cepa)* are rich in Vitamin B, including folate and Vitamin B6, it plays key role in metabolism, red blood cell production and nerve function. It is a good source of Potassium, a mineral which many people

are lacking, as potassium is required for normal cellular function, fluid balance, nerve transmission, kidney function and muscle contraction. The antioxidant squercet in and Sulphur.

Onion may lower blood glucose levels and improve glucose tolerance in people with diabetes. Onion has been used traditionally to treat diabetes. Specific compounds found in onion such as Quercetin and Sulphur compounds which help to promote insulin production in the body and hence possesses antidiabetic effects and becomes helpful in controlling blood sugar level.

We can take onions in salad form before food. We can consume onion for diabetes at any time if we do not have any other pre-existing health conditions. We should avoid eating onions at night as it has been found that eating them can increase heartburn and cause reflexes when you lie down at night.

The carbs in onions may cause gas and bloating. Diallyl disulphide and lipid transfer protein are certain compounds present in onions. They may lead to allergy symptoms like runny nose, asthma, red eyes, itchy rashes, and contact dermatitis.

Onion juice

1. Chop peeled onion into small pieces and add them to a blender.
2. Add some water and blend well.
3. Extract the juice using a strainer.
4. Add 1-2 teaspoons of honey.
5. Mix well and consume it as juice.

Onion and Cucumber Salad

1. Chop half an onion and half a cucumber.
2. Mix them properly in a bowl.
3. Add lemon juice, salt and pepper as per taste.
4. Mix well and consume it.

Garlic (*Allium sativum*)

Garlic (*Allium sativum)* is widely used around the world with a history of human use of over 7000 years for culinary and medicinal purpose [25, 26]. Garlic (*Allium sativum)* is a bulbous plant. The compound bulb is only part that is eaten and is used for medicinal purpose. Each bulb is made up of 4-20 cloves; they are grouped together between the membranous scales and are enclosed in a thin white, mauve or purple skin, which holds them in a sac. Leaves of Garlic are elongated, contracted and flat. The flowers are hermaphrodite in nature. They are whitish in colour and are placed at the end of a stalk rising direct from the bulb. Garlic (*Allium sativum)* is also a good source of vitamins B-6 and C. Vitamin B-6 is involved in carbohydrate metabolism. Vitamin C may also play a role in maintaining blood sugar levels.

The main function of Garlic on diabetes is in maintaining blood sugar level. This herb can decrease glucose level. The components such as allyl propyl disulphide and allicin in Garlic can be used as antihypertension which reduce the blood pressure, urine protein and plasma creatinine levels. Garlic also protects the kidney from diabetes nephropathy [27].

Consuming moderate amount of garlic (1 clove daily) can help regulate your blood sugar levels and improve insulin sensitivity. Garlic also keep heart healthier by reducing blood pressure and may reduce risk of cardiovascular events (such as heart attack and stroke) in patients with high blood pressure. Consuming raw garlic cloves with warm water on an empty stomach helps in cholesterol, weight loss and diabetes management.

might result in bad breath, bloating and other digestive issues. Garlic is quite potent both in taste and odor and safe to eat. There are minor side effects, if we eat raw garlic. Side effects include Heartburn, Gas, Nausea, Vomiting, Diarrhoea.

Important Nutritional composition of Garlic 100 g

Vitamin B6	1235(mg)
Vitamin C	31(mg)
Glutamic acid	0.805(g)
Arginine	0.634(g)
Aspartic acid	0.489(g)
Leucine	0.308(g)
Lysine	0.273(g)

It is recommended that let the chopped garlic sit for at least 5 minutes to allow allicin, one of the herb's main component to be at its highest concentration. This may enhance the herb's potential health benefits. Eating raw Garlic on an empty stomach can help in reducing the cholesterol level. The fresh raw Garlic contains Allicin and this components gets diluted during the process of cooking.to retain maximum nutrition; gobbling down raw garlic with the glass of water is the best remedy to improve heart health and also manage diabetes.

Garlic Tea:

Smash 1 garlic pod. Add 1 cup water to the pan and boil the tea for some time. When the tea is hot enough, add ½ teaspoon cinnamon. Allow the mixture to brew for 2 minutes and turn off the flame. Pour it in a cup and add 1 teaspoon honey and ½ teaspoon lemon juice.

Aloe-vera (*Aloe barbadensis*):

Aloe vera is a cactus – like plant that has been used for traditional medical purpose for thousands of years. *Aloe vera* has a long history of being used for medicinal purposes [28]. The leaves are composed of three layers: an inner layer gel, a yellow sap and the outer thick layer of 15-20 cells called as rind. *Aloe vera* leaves have long been used for medical and cosmetic purposes.

Aloe vera can be separated into two basic products: Latex and Gel. The latex is 20-30% by weight of the whole leaf, it is bitter yellow exudate from the pericyclic tubules beneath the epidermis of the leaf. Young leaves have higher concentration of latex components compared to older leaves. The Gel is colourless, tasteless, it is the pulp or mucilage from the parenchyma cells of the plant in the inner part of the leaf. The leaf pulp of *Aloe vera*contains 98.5% water and its alcoholic–insoluble portion was a mucilage containing uronic acid, fructose, hydrolysable sugars and enzymes.

pH	4.0-4.5 pH
Water	99.51 %
Fat	0.067 %
Carbohydrate	0.043 %
Protien	0.038 %
Vitamin A	4.594 IU
Vitamin C	3.4 mg
Calcium	458 ppm
Phosphorus	20.10 ppm
Fe	1.18 ppm
Magnesium	60.8 ppm
Mangan	1.04 ppm
Potassium	797.0 ppm
Sodium	84.4 ppm
Total Dissolved Solid (TDS)	0.490 %

Advantages of *Aloe vera* for Diabeties:

*Aloe vera*is relatively low in sugar. It cannot cure diabetes but prevents diabetes development among people in the prediabetes stage. It can also help manage blood glucose and lipids in diabetes patients.

Drinking *Aloe vera*juice on empty stomach is an effective way to lose weight, improve absorption of nutrients in our body and easy bowel function. *Aloe vera* juice also helps to maintain dental health. *Aloe vera* juice contains polyphenols, which are rich in antioxidants. Antioxidants have been shown to have several health benefits.

Excess use of *Aloe vera*results in hypoglycaemia, it is a condition where blood sugar level go below average, which is very dangerous [29].

Preparation of *Aloe vera* Juice (step-wise)

*Aloe vera*juice can help improve blood glucose level and is useful in treating people with diabetes [30]**.**

1. Add an *Aloe vera* gel (pieces):1/4 cup and add 1 cup of water and blend it until the aloe becomes crushed.
2. Strain the mixture into a cup and discard any traces of rind.
3. Add lemon juice and more water as required.

Preparation of *Aloe vera* Tea (step-wise)

1. Boil 2 cup water and steep 1 green tea bag in hot water for 3-4 minutes.
2. Squeeze the *Aloe vera* jelly taken out directly out from 1 *Aloe vera* leaf.
3. Mix well and strain.

Preparation of *Aloe vera* Salad (step-wise)

1. Mix *Aloe vera* leaf (de-skinned and chopped) ½ cup, Basil leaf ¼ cup, Chopped carrot ¼ cup, Sliced tomatoes 1 cup, Cooked beans of any variety ½ cup, Chopped cucumber ½ cup, Crushed pepper ½ teaspoon, Sliced lettuce ½ cup, Salt (a pinch) well.
2. Refrigerate for 10 minutes and serve.

Conclusion

Diabetes mellitus is considered as one of the leading cause of death in the world. Diabetes is one of the chronic disorders which are associated with high mortality risk. Diabetes is mainly due to oxidative stress and an increase in reactive oxygen species that can have major effects. Many plants contain different natural

antioxidants specially tannins, flavonoids, C and E vitamins that have the ability to maintain β-cells performance and decrease glucose levels in the blood. Natural products are known to play an important role in pharmaceutical biology. . Several anti-diabetic phytoconstituents have been isolated from medical plants and these were of chemically diversified nature which includes flavonoids, glycosides, terpens, polysaccharides and polypeptides. Thus, all these properties together make Neem (*Azadirachta indica*), Karela (*Momordica charantia*), Onion (*Allium cepa*), Garlic (*Allium sativum*), Aloe-vera (*Aloe barbadensis*) great herbs for Diabetic patients.

References:

1. Osadebe PO, Odoh EU, Uzor PF. The search for new hypoglycemic agents from plant. African Journal of Pharmacy and Pharmacology. 8(11):292-303.
2. Abdel-Barry JA, Abdel-Hassan IA, Al-Hakiem M.H, (1997). Hypoglycemia and Anti-hyperglycemia effect *Trogonellafoenum-graaecum* leaf in normal and alloxan- induced diabetic rats. *J Ethnopharmacol*, 58:149-155. [Google Scholar]
3. M.K. Ali, K.M.V. Narayan and N. Tandon, ”Diabetes & coronary heart disease: current perspectives,” *Indian Journal of Medical Research*, vol.132, no.11,pp.584-597,2010.
4. World Health Organization, “Traditional medicine-growing need and potential,” *WHO Policy Perspective on Medicines*, vol 2, pp.1-6, 2002
5. M. Simmonds and M. Howes, “Plants used in the treatment of diabetes,” in *Traditional Medicines for Modern Time – Anti-diabetic Plants, A. Soumyanath*, Ed., vol. 6th, pp. 19-82, CRC Press/Taylor and Francis Group, 2006.
6. Paulweber, B., Valensi, P., Lindstrom, J.,Lalic, N.M., Greaves, C.J., McKee, M.,….& Yilmaz, T. (2010). *A European evidence-based guideline for the prevention of type-2 diabeties. Hormone and Metabolic research*, 42(So1), S3-S36.
7. Daharia, A., Jaiswal,V.K., Royal, K.P., Sharma, H., Joginath A.K., Kumar, R., & Saha, p. (2022). *A Comparative review on ginger and garlic with their Pharmaceutical Research and Development*, 10(3), 65-69.
8. Nyarko, R.O., Kumar, R., Sharma, S., Chourasia, A., Roy, A., & Saha, P. (2022). *Antibacterial activity of Herba Plants- TinosporaCordifolia and Catharnthus Roseus.*
9. Jacob E. Friedman. New transcription factors and their role in diabetes and therapy 1ST ed, Oxford: Elsevier. (2006), 1-67.
10. Singh S.K., Rai P.K., Jaiswal D., Watal G. Evidence based critical evaluation of glycemic potential of Cynodondactylon. Evid Based Complement Alternate Med. 2008; **5**:415-20.
11. Venkateswaran S., Pari. L. Effect of Coccina indica leaves on antioxidant status in streptozotocin-induced

diabetic rats. *J Ethnopharmacol*. 2003; 84:163-8.

12. American Diabetes Association. Standards of medical care in diabetes. Diabetes care. 2007, 30:4-41.
13. Sharma B, Salunke R, Balomajumder C, Daniel S, Roy P. Anti-diabetic potential of alkaloid rich fraction from capparis decidua on diabetic mice. *JEthnopharmacol*2010; 127:457-62.
14. Jacob E.Friedman; New transcription factors and their role in diabetes and therapy. 1st ed, Oxford: Elsevier. (2006), 1-67.
15. Biswas,K., Chattopadhyay, I., Banerjee,R.K., &Bandyopadhyay.U.(2002). Biological activities and medicinal properties of neem (*Azadirachta indica*). *Current Science – Banglore*-82(ii) 1336-1345.
16. Subapriya, R., &Nagini,S.,(2005). Medicinal properties of neem leaves: a review. *Current Medicinal Chemistry- Anti-cancer Agents*, 5(2) , 149-156.
17. Akhila, A. & Rani., K. (1999). Chemistry of the neem tree (*Azadirachta indica).* In Fortschritte des chemieorganischernatursoffe / Progress in the chemistry of Organic Natural Products (pp.47-149. *Springer, Viemma.*
18. Brahmachari, G.(2004). Neem-an omnipotent plant: a retrospection. Chembiochem,**5(4),** 408-421.
19. Siddiqui,B.S., Afshan, F., Gulzar, T., & Hanif, M. (2004). Tetracyclic triterpenoids from the leaves of *Azadirachta indica*. Phytochemistry, 65(16), 2363-2367.
20. Singh, U.P., Maurya, S., & Singh, D.P. (2005). Phenolic acids in neem (*Azadirachta indica*) a major pre-existing secondary metabolite. Journal of herbal pharmacotherapy, 5(1), 35-43.
21. Gupta, S.C., Prasad,S., Tyagi, A.K., Kunnumakkara, A.B., & Aggarwal, B.B.(2017). Neem (*Azadirachta indica*): An indian traditional panacea with modern molecular basis. Phytomedicine, 34, 14-20.
22. Thakur, M., Sharma, R.K, (2016).Bitter gourd: health properties and value addition at farm scale. Available from: www. Marumegh.com. Availabe at: http://www.researchgate.net/ publication/ 312580416_
23. Kumar. K.P.S., Bhowmik, D. Traditional medicinal uses and therapeutic benefits of *Momordica charantia* Linn. Int J Pharm Sci Rev Res. 2010; 4(3):23-8.
24. Ensminger AH. Foods and Nutrition Encyclopedia. CRC Press 1994; 1: 750.
25. Simonetti G, Schuler S.Simon and Schuster's guide to herbs and spices. Middle-East J Sci Res 1990; (1):75.
26. Parle M, Kumar Vaibhav. Garlic- A Delicious Medicinal Nutrient. In:Trivedi PC, editor. Indian Folk Medicine. Jaipur, India: Pointer Publisher; 2007.p. 210-29.

Dr. Sadguru Prakash [M.Sc., Ph.D.]

Dr. Prakash has started his academic career in the Department of Zoology, MLK PG College, Balrampur (U.P.) in 2003. He has published more than 110 research papers, 25 book chapters and 05 books/edited books with around 1500 Google Scholar Citations (h-index: 18 and i10-index: 36). He is recipient of about 02 dozens of reputed awards of National and International fame including Dr.APJ Abdul Kalam Green Environment Promotion Award, Innovative Educationist Award, Innovative Zoologist Award, LBS Glocal Award for Biodiversity and so on. Besides, he is a Fellow of more than 10 academic/environmental/social societies and attended more than 35 national and international conferences and organized about 10 conferences. Dr Prakash is a member of Research Advisory committee and Board of Studies of Siddharth University, Kapilvastu, Siddharthnagar and actively involved in research and serving as Editor and reviewer of a number of academic journals.

Dr. A.K. Verma [M.Sc. (Gold Medalist), Ph.D., D.Sc. (*honoris causa*)]

Dr. Verma, A. Professor of Zoology, Govt. PG College Saidabad-Prayagraj (U.P.) has published 105 research/review articles, 10 book chapters and 11 books/edited books. His current **Google Scholar Citations are more than 2000 (h-index: 25 and i10-index: 70)**. He supervised 01 Ph.D. student and successfully organized 15 national and 16 international conferences/seminars/webinars and actively participated in more than 100 conferences. Dr Verma has been former Convener of Board of Studies and Member of Academic Council of PRSU, Prayagraj and subject expert of Zoology RDC of Dr RML Avadh University Ayodhya and subject expert of Environmental Science Board of Studies of Govt. KRG PG (Autonomous) College, Gwalior (M.P.), Maa Shakumbhari University, Saharanpur (U.P.). He is Editor-in-Chief of **International Journal of Biological Innovations (IJBI)** and editorial board member of about 15 research Journals. He has received about 71 most prestigious awards of Regional, National and International repute including **Saraswati Samman 2017** (The highest award of Education Department, Govt. of Uttar Pradesh). Besides, he has received Fellowships of 17 well reputed academic societies of global fame. Dr. Verma is popularly known as **"Man of Awards and Honours"**. He is currently working on biodiversity/nature conservation and ecological balance and is actively involved in conservation, sustainable development and management of **Indian Sarus Crane** (state bird of Uttar Pradesh) in and around district Kaushambi (U.P.). Owing to his concern towards environment and sustainable development, he has started a new healthy tradition of gifting plants in birthday and marriage anniversary celebrations. Added to this, the tradition is also being continued with guests and speakers during conferences in order to maintain a clean and green natural environment.

Prof. R.C. Mishra [M.Sc., Ph.D.]

Dr. Mishra is currently Vice Chancellor of Mahakaushal University, Jabalpur (M.P.). He has completed his masters from GBP UAT, Pantnagar (U.K.) and Ph.D. from University Allahabad, Allahabad. He has published around 100 research/review articles/book chapters and several books/edited books. He is a Fellow of Asian Biological Research Foundation (ABRF) and recipient of about two dozen awards and honours. He has successfully completed several projects funded by DST and organized many workshops/ seminars/ webinars etc.

Prof. Madhu Laxmi Sharma [M.Sc., Ph.D., D. Litt. (hon.)]

Dr. Sharma, Professor of Botany, Govt. KRG PG (autonomous) College, Gwalior (M.P.) has published about 25 research/review articles, 5 book chapters and 5 books/edited books. She has more than 42 years of teaching experience. She has received about 31 most prestigious awards and 12 fellowships of different academic/research related societies. She was master trainer of Semester system in higher education, Madhya Pradesh, organized about one dozen workshops/seminars/webinars and attended more than 200 National/International conferences.