15th Annual National Conference on
“Wetlands and Water”
Organized by
Paryavaran Dakshata Mandal
In Collaboration with
Association of Teachers in Biological Sciences
&
Satish Pradhan Dnyanasadhana College, Thane
On 2nd February 2021

Enviro-Vigil, Thane
As part of Paryavaran Dakshata Mandal's
“CLEAN CREEK MOVEMENT”

PC: MR. PRASAD DATE ISBN 978-81-926582-0

Editorial Board

- ❖ Mr. Vidyadhar Valawalkar (President, Enviro-vigil, Thane)
- ❖ Dr. Sanjay Joshi (Vice-president, Enviro-vigil, Thane)
- ❖ Dr. Hemant Chitte (Principal, Satish Pradhan Dnyanasadhana College, Thane)
- ❖ Dr. Sanjyot Devuskar (Vice-principal, Satish Pradhan Dnyanasadhana College, Thane)
- ❖ Dr. Prasad Karnik (Vice-president, Paryavaran Dakshata Mandal, Thane)
- ❖ Dr. Purushottam Kale (Execute Committee Member, Paryavaran Dakshata Mandal, Thane)
- ❖ Dr. Sasikumar Menon (General Secretary, ATBS)
- ❖ Dr. Bimal Nath (Vice-President, ATBS)

INDEX

Sr. No.	Particulars	Page Number
1	Welcome Address: Chitte, H. K.	5
2	PDM & Social Perspective of Clean Creek Movement: Valawalkar, V.	6
3	Convener's Address and Scientific Perspective of Clean Creek Movement: Karnik, P.C.	7
4	Message: Prabhu, S.	8
5	Key Note Address: Kale, P.G.	9-12
6	Dr. Kodarkar Memorial Lecture: Tatu, K.	13-14
7	Research Papers	
7.1	Group A	
7.1.1	Review article The Impact of Impervious Surface on Lake Water Quality in Thane by Nikte, P.	15-23
7.1.2	Review article An Ecocritical Reading of Water Stories from around the World by Shajeev, R.	24-35
7.1.3	Review article Sustainable Development of Nandur Madhmeshwar Wetland for Health and Food by Gangurde	36-38
7.1.4	Review article New perspectives on climate change by Bagul and Chavan	39-41
7.1.5	Review paper Conservation of Wetlands for Sustained Food Security and Health: A reflection by Kale, P.G.	42-47
7.1.6	A Review on Impact of climate change on some important wetlands of Maharashtra by Ingle, M.	48-55
7.2	Group B	
7.2.1	Sustainable Development and Conservation of Wetlands using precast concrete by Khan, Mirekar, Bhatkar and Uma Kale	56-60
7.2.2	Review article A survey on status of wetlands for biodiversity conservation by Aakriti Tamrakar	61-67
7.2.3	Review article Bioremediation for wetlands by Gawali, Hosmani, Bhosle, Bankar, Uma Kale	68-77
8	Oral Presentations	
8.1	Group B	
8.1.1	Wetlands ecosystem and management of freshwater resources by Bind, S. and Mallia, J.	78-85
8.1.2	Wetland conservation for sustainable biodiversity by Shukla, K., Bukane, S. and Mallia J.	86-92
8.1.3	Climate change, Water Crisis and Wetlands by Pranali Ranshur	93-96
8.1.4	Climate change, water crisis and Wetlands by Rathod	97-98
9	Poster Presentation	
9.1	Group A	
9.1.1	Sustainable Development of Wetlands for Water Crisis Management by More and Navale	99-100
9.2	Group B	
9.2.1	Climate change, Water crisis and Wetlands by Ansari Iffat Shafique	101-102
10	Essay	
10.1	Group A	
10.1.1	Wetlands and Management of freshwater resources by Ankita Das	103-107
10.2	Group B	
10.2.01	नमोभूमि और जल by Aakriti Tamarkar	108-110
10.2.02	Wetlands and water by Gulavae, A.	111
10.2.03	The Impending doom Water Crisis and Wetlands by Meherwade, A.	112-113
10.2.04	Climate change, water crisis and wetlands by Singh, G.	114
10.2.05	Climate change, water crisis and wetlands by Sahani, M	115-116
10.2.06	Economics for Sustainable Development and Conservation of Wetland by More, M.	117
10.2.07	Economics for Sustainable Development and conservation of wetlands by Patil, M	118-120
10.2.08	पाणी संकट आणि जल संवर्धन by Raysingh, N	121-122
10.2.09	Thane Creek by Singh, N	123-124
10.2.10	Economics for Sustainable Development and conservation of wetlands by Yadav, P	125-127
10.2.11	हवामान बदल पाणी संकट आणि आर्द्रता by Pathak, P	128-129
10.2.12	Climate change, water crisis and wetlands by Matkar, P.	130-131

10.2.13	पाणथळ जागेचे संवर्धन आणि शाश्वत आर्थिक विकास by Rathod, G.	132-133
10.2.14	Climate change, water crisis and wetlands by Vishwakarma, R	134
10.2.15	Conservation of Wetlands by Chawarkar, S.	135-136
10.2.16	हवामान बदल पाणी संकट आणि आर्द्रता by Vardhaman, S.	137-139
10.2.17	Economics and sustainable development and Conservation of wetlands by Jha, S.	140-141
10.2.18	Climate Change, Water crisis and wetlands by Gosavi, T.	142-143
10.2.19	Climate change, water crisis and wetlands by Tripathi, V	144-145
10.2.20	Climate change by Maurya, V.	146-147
11.1	Documentary Films	
Group B		
11.1.1	Wetlands and Water by Tamarkar, A.	148
11.1.2	Study of Temporary and Permanent Wetlands in Shirdi by Shaikh, Solase and Dighe	149
12.1	Short Communication	
Theme Abstracts		
12.1. 1	Climate change, Water crisis and Wetlands by Joshi, S.	150
12.1. 2	Wetlands & management of Freshwater by Nikam, S.	151
12.1. 3	Wetlands for Health and Food Sustainability by Karnik, P.C. and Shaiwale, R. L.	152
12.1. 4	Sustainable development and conservation of wetlands of Masunda lake by Shirgaonkar, P. M.	153
12.2	Gr A Research article	154
12.2.1	Wetlands of Pampore Kashmir Himalaya and their conservation by Jahangeer R., Jaya S., Ishtiyag A.N.	
12.3	Oral Presentation Group A	155
12.3.1	Water quality assessment of three different wetland of Tal region of Malda district and its impact on aquatic life and socio economic values by Md Ashif Ali, Ahmad, S., Jamal, S	
12.4	Oral Presentation Group B	156
12.4.1	Ecological study of phytoplankton from Dandi Creek-West Coast of India by Kadam, S. and Samal, D	
12.4.2	Economics of sustainable development & conservation of wetlands by Ansari Iffat Shafique	157-158
12.4.3	Wetlands for health and food sustainability by Dhage, M	159-160
12.5	Poster	
12.5.1	Wetlands for health and food sustainability by Limbani J	161
12.5.2	Climate change, water crisis and wetlands by Rathod	162
12.5.3	Conservation of Wetlands by Menga, D	163
12.5.4	Climate change, water crisis and wetlands by Gholap, V. and Gupta, S	164
13	Summary of Conference	165
14	Photographs of the conference	166-171

WELCOME ADDRESS

Dr. Hemant Chitte, Principal, Satish Pradhan Dnyanasadhana College, Thane

The convention on Wetlands was adopted in the Iranian city of Ramsar in 1971 and came into force in 1975. Since last 50 years, efforts have been taken to save wetlands, however with the growing demands for water due to increased population, pollution, industrialization in addition to the induced climate change thus resulting in water crisis and diminishing wetlands.

There is a dire necessity to conserve water for sustainable development and therefore the theme for 50th anniversary year of the Ramsar Convention on Wetlands is Wetlands and Water.

With a similar objective to highlight the significant role of wetlands for freshwater security and accelerate the conservation strategies amongst the younger bright minds and spread awareness in the masses, the 15th Annual National Conference on 'Wetlands and Water' is organized by Paryavaran Dakshata Mandal jointly with Satish Pradhan Dnyanasadhana College, Thane; Association of Teachers in Biological Sciences and Enviro Vigil, Thane.

I wish good luck to all students who have participated in the competitions and the Conference a great success

Paryavaran Dakshata Mandal's Clean Creek Movement

Mr. Vidyadhar Valawalkar, President, PDM

Paryavaran Dakshata Mandal (PDM) is an NGO- working in the field of Environment Awareness through Education, training & Research for the last more than 20years. PDM is implementing Clean Creek Movement (CCM) for the last more than 15years. With its aim of creating awareness through education & research in Environmental issues, PDM runs CCM for restoration of Thane Creek specifically- with the help of various events, programs and activities. The core focus is on students. The students are the best torch-bearers to enlighten the entire society. Celebration of World Wetlands Day (WWD) on 2nd February and World Mangrove Day (WMD) on 26th July, are the major activities PDM undertake for effective implementation of CCM as it involves not only the local students-teachers & general public, but the local stakeholders also. After establishing CCM in Thane District (Creek belt, mainly), PDM enhanced the scope to Mumbai & Navi Mumbai. Practically, PDM has covered almost entire Mumbai Metropolitan Region (MMR).

2021 bring PDM and thereby the WWD celebration on online platform due to the pandemic situation. PDM is organizing this conference with Association of Teachers in Biological Sciences, Satish Pradhan Dnyanasadhana College, Thane and Enviro-Vigil, Thane.

Paryavaran Dakshata Mandal (PDM), Thane- which became the Thane Chapter of the Mangroves Society of India (MSI) later- was one such NGO, working in the fields of Environmental Awareness, Education & Research from late 1990s and initiated “Clean Creek Movement (CCM)” from early 2000s. PDM call it as “Clean” Creek Movement and NOT “Cleaning” Creek Movement as the only practical solution to bring this great Wetland to its former Natural Glory is NOT by Cleaning the creek (that’s impossible and hence, impractical) but by Keeping the Creek Clean. This, in turn, is possible by preventing any waste to be dumped in the Creek & nearby Wetland! Thus, reaching out to the local population was inevitable and PDM is doing it for more than 15yrs through Students.

PDM started Jal-Saksharata Abhiyan in 2004. CCM was initiated as part of this Abhiyan. Eventually, it became an independent Movement, an on-going project with active participation of local population. First formal World Wetlands Day was celebrated by PDM in 2007 with Thane Municipal Corporation and in 2008, with Birla College Kalyan. From then onwards, WWD became a National Conference, celebrated with very many colleges from Thane & Mumbai Dists.

We are confident that this Conference and its e-proceedings will create & spread the necessary awareness among the classes & masses locally, and otherwise, too.

Convener's Address

Dr. Prasad Karnik, Vice-President of Paryavaran Dakshata Mandal (PDM) and the Mentor, Clean Creek Movement (CCM), welcomed the participants in the capacity of the Convener of this Conference to celebrate World Wetlands Day 2021. He wished to have meaningful and fruitful deliberations regarding the well-being of wetlands in India. He expressed his happiness to find many registrations for this one-day Conference from the students, teachers, researchers and people from other walks of life from across our country.

Dr. Karnik gave the background of the WWD celebrations that dated down to 1971 when on February 02 in that year, scientists, researchers and the policy makers gathered in the city of Ramasar in Iran along the lake named after the city. The importance & significance of the Wetlands (not wastelands, according to the Convener) was underlined and it's decided to create proper awareness for Wetlands Conservation. Karnik sir went on to mention how the actual; celebration was initiated in 1986 and how PDM (Paryavaran Dakshata Mandal) started to observe this day for the last 14years with different city- an educational institute therein, local governing body and various NGOs in that city.

The Convener's address was concluded with the entire day's itinerary and welcoming the guests and other dignitaries.

The Convener, being the Mentor of the Clean Creek Movement (CCM) of PDM, made a separate presentation on the scientific perspectives of the activity. The social aspects were already explained by the PDM President Prof. Vidyadhar Walavalkar (and that's included in these e-proceedings).

Prasad Karnik sir took the audience through the Thane Creek Tour of the Technical Team of PDM for 2021 and presented the findings of the water sampling of about 25 sampling stations along the entire stretch of the Creek. He highlighted the fact in the finding that the solid waste has continued to be in lesser quantities and avi-fauna and the other faunal presence is on very little rise. He mentioned the increase in the shore encroachment by few developmental projects, absence of dissolved oxygen in creek water (grave situation continues unchangingly) and indiscriminate cutting off of the Mangroves along the Thane Creek coast.

The presentation concluded on the optimistic note of changing the dire situation of the Creek with everyone's contribution. The Convener Dr. Prasad Karnik thanked everyone for responding to PDM's appeal to save, conserve and improve the Wetlands, in general; and, the Thane Creek, in particular by participating in the WWD 2021 Conference.

Message form Hon' Mr. Suresh Prabhu

Hon'ble Shri. Suresh Prabhu, Sherpa of India for G-7 & G-20, was to preside over the inaugural function of the WWD 2021 organized by PDM, ATBS, SPDC & Enviro-Vigil on virtual platform. Shri. Prabhu was the pioneer of the river-linking project and hence, the organising committee thought of inviting him considering the theme of WWD 2021, *i. e.* Water, Wetlands and Life. Prabhu sir initially had kindly agreed to attend the on-line conference inaugural ceremony. The last-minute scheduling of the G-20 meeting prevented him from the same. None the less, Shri. Prabhu sir sent an audio clip and wished the conference his blessings. The clip was played in the inaugural ceremony. This message was a morale booster for all of the organizers.

Shri. Suresh Prabhu underlined the importance of the wetlands, mentioned the Ramsar Convention and elaborated the necessity to protect the wetlands, the world over. The destruction and great loss on environment was emphasized by him and he reiterated the significant role of wetlands (as living system) to support many other living beings. He praised PDM's attempts to create awareness among masses and for arranging such events. He wished the conference best luck and blessed the organizers for the good work they are doing.

Key Note Address on Wetlands and Water

Dr. Purushottam G. Kale,

General Secretary, Association of Teachers in Biological Sciences and Member, Executive Committee,
Paryavaran Dakshata Mandal.

Wetlands are inseparable from water by their definition itself. We boast that India is ‘Sujlam and sufalam’, blessed with abundance of water and fertile land. In most other countries the situation has not been much different a century or so in past. Unfortunately, however, our lack of respect towards wetlands, led to a situation forcing us to have a global conference on conservation of water bodies and wetlands. This global convention was organized on 2nd February, 1971, at Ramsar city in Iran. To commemorate this day, the world leaders agreed on observing 2nd February as the ‘World Wetlands Day’.

For this year’s celebration of the WWD the standing committee has approved the theme as “Wetlands and Water” and we, the organizing committee of this conference adopted the same title.

Under this title our organizing committee decided to have subthemes as:

Climate Change, Water Crisis and Wetlands;

Wetlands and Management of Freshwater Resources;

Wetlands for Health and Food Sustainability; and

Economics of Sustainable Development and Conservation of Wetlands.

The main objective of observing the World Wetlands Day as well as the organizing committee of this conference is to spread awareness towards the importance of conservation of Freshwater Wetlands.

As we all are aware, the over exploitation of natural resources world over has ensued the global climate change. This has resulted in unpredictable distribution of precipitation, in space, time and amount. The season cycles have been altered. The frequency and severity of natural catastrophes have increased.

Wetlands being high carbon ecosystems would help in reducing the carbon overload in the atmosphere but unfortunately these are vanishing at an overwhelming speed. In the 20th century itself, the extent of inland freshwater wetlands, around the world, have declined by about 65%. Conversely, the drainage or damage of the wetlands like peat lands is a major source of greenhouse gases.

Wetlands are a source of water for agriculture, aquaculture, dairy, industries and household. Their conservation can sustain the livelihood of populations around them. If the climate change is to be thwarted, if not reversed, it is necessary to restore, conserve and manage these wetlands. Well managed wetlands provide many ecosystem services like filtration and purification of water; replenishment of ground water; flood control; sediment and nutrient retention and supporting biodiversity. This in turn, ensures sustained health, food security as well as the socio-economic status of the residents of the surrounding villages & cities.

The Directory of Asian Wetlands (1989), states that excluding rivers the wetlands occupy 18.4% of the country's area, of which 70 % wetlands are under paddy cultivation. Of the estimated 4.1 mha of wetlands in India, 1.5 mha are natural, while 2.6 mha are manmade.

The uncontrolled increase in human population has led to a use of freshwater far in excess of the nature's capacity to replenish. The number of freshwater resources is diminishing because of our indifference and lack of management. This has led to a serious crisis for water, worsening year after year. It is said that if ever, a third world war is fought, it would, in all probabilities, be for the control of freshwater resources.

Although India harbours about 18% of the population of the world, it shares as little as 4% of the world's freshwater resources. Ministry of Water Resources, River Development and Ganga Rejuvenation, issued guidelines for the 'Repair, Renovation and Restoration (rrr) Scheme of Water Bodies under Pradhan Mantri Krishi Sinchayee Yojana' in June 2017. When accomplished, it may provide an additional 2.23 lakh hectares of freshwater resources. Under the Atal Bhujal Yojana, 2000, the ministry has taken up the artificial ground water recharge. This too is expected to increase availability of freshwater.

A National Water Mission was founded in 2011 to conserve water, minimise its wastage and assure equitable distribution through integrated water resources development and management practices.

National Water Development Agency (NWDA) of the Ministry of Water Resources is coordinating the ambitious 'Indian River Interlink Project'. Despite the objections to it, if completed it will ensure a better irrigation and drinking water supply besides solving the problems of flooding and drought.

Under 'Rashtriya Krishi Vikas Yojana', farm pond schemes have been operative, in many states of India, to ensure the water supply for agriculture. India claims to have achieved self-sufficiency in food production, though, 22% of its population is below the poverty line. India shares 25% of the agricultural produce of the world yet is a home to about one quarter of the global total of malnourished people. Based on the Global Hunger Index prepared by International Food Policy Research Institute, in 2018, India ranks 103rd out of 119 countries. The same report states that in 2015, 21 % of the children fewer than 5 years of age were wasted and 38% were stunted. Contrary to this, over 16% the people are overweight and obese due to over-nutrition and over-consumption of calories. This is leading to higher rates of diabetes and other non-communicable diseases, morbidity and mortality, particularly in the urban areas. In rural India, however, poverty induced malnutrition is the major cause of morbidity and mortality.

No doubt that these paradoxes are primarily due to fast growing population of India, (in mid-January, the population of India crossed the figure of 138 crores) but there seems to be a reason for blaming it on the misjudged policies of the Government of India. According to the survey of the Organization for Economic Co-operation and Development (OECD) and the Indian Council for Research on International Economic Relations (ICRIER), over the last 2 decades, India has implicitly taxed agriculture at the rate exceeding 14%, largely by keeping food prices low for urban consumers. Due to the lack of integrated programme, the remedial steps taken through our successive five-year economic plans since 1951, failed to effectively conserve the freshwater ecosystems. More serious efforts are needed to conserve wetlands for sustaining food security, development and wellbeing in India.

Sustainability was the focus of the 1992 Earth Summit and has been occupying the central theme in all subsequent environmental studies. Sustainable development is an approach to economic planning that fosters economic growth while preserving the quality of the environment for future generations.

Though the concept of sustainable development has been enormously popular since the last several decades, it is still difficult to apply, primarily because the success of it takes a long time to establish. For example, growing a forest would provide sustained yield of timber only after tens of decades.

The measures necessary to address environmental problems typically result in social and economic hardships in the countries that adopt them. Therefore, many countries, particularly in the developing world, are reluctant to enter into environmental treaties. Intergovernmental treaties include financial cooperation, technology transfer, implementation schedules and obligations. In most agreements, the enforcement is treated as a domestic issue, an approach that effectively allows each country to define compliance in its best interest.

The sustainable development and conservation of freshwater wetlands can be integrated using a mix of public policy and economic solutions. This may further be assisted by continued monitoring and education.

The environmental educators and activists have been using ‘Ecological Footprint’ as the index to raise awareness towards wasteful, unsustainable consumption patterns, encouraging a change in lifestyles. The practice such as organic farming, for example, results in lower yields than conventional agriculture but would have bigger ecological benefits.

In all our agricultural, industrial, energy, transport, recreation, tourism and other sectors appropriate changes in lifestyle can help sustaining the development.

Positive steps towards conservation of Wetlands

The National Wetlands Inventory Assessment (NWIA) project of MoEFCC, launched in 2010, marked the beginning of serious efforts towards conservation of wetlands in India.

The National Plan for Conservation of Aquatic Ecosystems (NCPA), 2013, was made by merging National Lake Conservation Plan (NLCP) and National Wetlands Conservation Programme (NWCP) under 12th five-year economic plan. The idea was that *a single programme would help promote better synergy and avoid overlap of the administrative functions.*

In the same year, the National Food Security Act, 2013 was passed to substantiate the existing food security programmes of the Government of India like the Midday Meal Scheme (1995), Integrated Child Development Services Scheme, Public Distribution System and maternity entitlements.

In 2018, the Ministry of Drinking Water and Sanitation launched the ‘Swajal’ scheme in around 115 rural districts in India to provide clean drinking water under the existing National Rural Drinking Water Programme (NRDWP). In 2019, the Union minister Gajendra Singh Shekhawat launched the ‘Jal Shakti Abhiyan’, aiming to renovate water bodies; minimise wastage of water; regulate the industrial use of water; promote recycling of waste water; rainwater harvesting and providing piped water to every household within the next five years.

The guidelines with several strategic measures to conserve inland as well as coastal wetlands were released by National Plan for Conservation of Aquatic Ecosystems, MoEFCC in 2019. Using the Satellite data, nationwide inventory of wetlands and an Atlas showing 19 categories of wetlands from States and UTs has been prepared by ISRO. Over 2 lakh wetlands covering around 4.63% of the total geographical area of the country have been mapped. The concept of ‘Wetlands Health Card’ has also been introduced. In this the information about each wetland including its boundaries, area of influence, ecology, hydrology, fisheries, livelihoods it supports,

aesthetic and socioeconomic value, the villages in the vicinity and the approach roads, is being recorded. The ecosystem services of the wetlands will also be assessed besides the features such as geomorphology, meteorology, soil and sediment quality, and biodiversity. The concessions and regulations for the residents around the freshwater wetlands would be determined. With due consideration to all this, under the strategy 1.4, an integrated development and conservation plan and its execution as well as administration would be determined.

There is thus scope to believe that these conservation efforts will bear fruits in near future and the freshwater wetlands will see a golden era.

Dr. Kodarkar Memorial Lecture: Dr. Ketan Tatu
Senior Scientist, Gujarat Ecological Education and Research Foundation

Understanding Wetlands and their Threatened Species

Understanding wetlands:

Wetlands are area wherein water is the primary factor shaping plants and animal community. They are the areas where the land is either covered by shallow water and where land is saturated with water (Surface water or ground water). Wetlands are lands transitional between terrestrial and aquatic system. E.g. Nul sarovar is located between terrestrial uplands and Gulf of Cambay. The watery land areas qualify as wetlands if it satisfies one or more of the following attributes:

1. The land predominantly supports hydrophytes
2. The substrate is predominantly undrained hydric soil.
3. The substrate is non-soil that is saturated with water or covered by shallow water at some time during each year.

Ramsar Convention Definition of Wetlands:

Areas of Marsh, Fen, Peat-lands and water that is natural or artificial, permanent or temporary with water that is static or flowing, Fresh, Brackish or salt including areas of marine waters, the depth of which at low tide does not exceed 6m at low tide.

About Ramsar Sites:

1. There are 2414 Ramsar sites in world located at 171 countries and covering 2.5 million sq. Km area.
2. Till 2018-19, there are 27 Ramsar sites in our country.
3. Today, 2021 there are 42 Ramsar sites covering 10,814.4 sq. Km area which is 0.33 % of the country's geographical area.
4. Maharashtra state has 2 Ramsar sites, Nandur-Madhameshwar (Area 14.37sq. Km.) near Nasik and Lonar lake (Area 4.27 sq. Km.) in Buldhana District.
5. Proportion of wetland area in Maharashtra with respect to India's total wetland area is 6.65%.

Importance of Wetlands:

- Wetlands are widely recognized as biodiversity epitomes.
- It provides a wide range of ecosystem goods such as food, fodder and drinking & irrigation water.
- It also provides many ecosystem services like water purification, climate regulation and ground water recharge.
- It provides breeding ground for numerous species of fish, invertebrates and many birds.

Freshwater systems are among the most endangered habitat in the world due to human development, pollution and climate change. Global Climate change is recognized as a man-induced threat to the health of freshwater ecosystem. All the direct and indirect impact of human society has threatened the existence of many species. A large number of wetland species have become threatened mainly due to wetland destruction and degradation.

IUCN Threat Levels:

- Critically Endangered (ER) 80% population reduction over last 10 yrs.
- Vulnerable (VU) 30 % population reduction over last 10 yrs.
- Near Threatened (NT) close to meeting the threatened thresholds
- Conservation Dependent (CD)
- Least Concerned (LC)

Some threatened species of India that are known to occur in Maharashtra are:

1. Lesser Adjutant (VU) Chhota Kshetrabalak
2. Sarus Crane (VU)
3. Marbeled Teal (VU) Aaraspani Badak, Migratory Bird
4. Common Pochard (VU) Chhota Lalsari
5. Greater Spotted Eagle (VU) Motha Thipkedar Garud
6. Indian Skimmer (EN) Panchiri
7. Black Bellied Tern (EN), Kaalya Potacha Suray
8. Indian River Tern (VU)Nadee Suray
9. Greater Adjutant (EN) Motha Shatrabalak

Conclusion:

Destruction of nesting, destruction of wetlands through drainage and conservation, mining, damming of rivers, pollution from agricultural and industrial chemical, lead poisoning are major threats to all wetlands birds. Critically endangered Terrestrial bird depending on wetlands is White Rumped Vulture. They need wetlands for bathing and drinking purpose. Many terrestrial wildlife species and hydrophytes species need wetlands. So we need to conserve wetlands.

The Impact of Impervious Surface on Lake Water Quality in Thane, Maharashtra

Priti Nikte, Satish Pradhan Dynanasadhana College, Thane

1. Introduction-

The process of urbanization and industrialization has led to an increase in the amount of impervious surfaces (IS), dramatically impacting hydrology, stream channel geomorphology and physicochemical quality of water. Impervious surface (IS) is defined as any materials that prevent the water into the soil. Is are mainly constructed surfaces covered by impenetrable materials such as asphalt, concrete and stone. Schueler (1992), categorized IS into transportation system (roads, sidewalks, parking lots) and rooftop (residential, housing, buildings. Malls etc.). The negative impacts of impervious cover growth to the natural environment especially in watershed ecosystems have been widely recognized problem throughout the world (Arnold and Gibbons, 1996).

Previous research consistently shows a strong correlation between imperviousness of a drainage basin and the health of its receiving stream (Klein, 1979, Griffin 1980, Schueler 1987, 1992 and 1994, Booth and Rein felt 1993). Schuler 1992 presented a schematic scale to represent the relation between the ISA (%) of a watershed and its health status. In India most of the water bodies (including rivers and lakes) are getting highly polluted due to urbanization and industrialization (CPCB, 2011), similarly different anthropogenic activity like constructed surfaces also caused a change water quality in urban area.

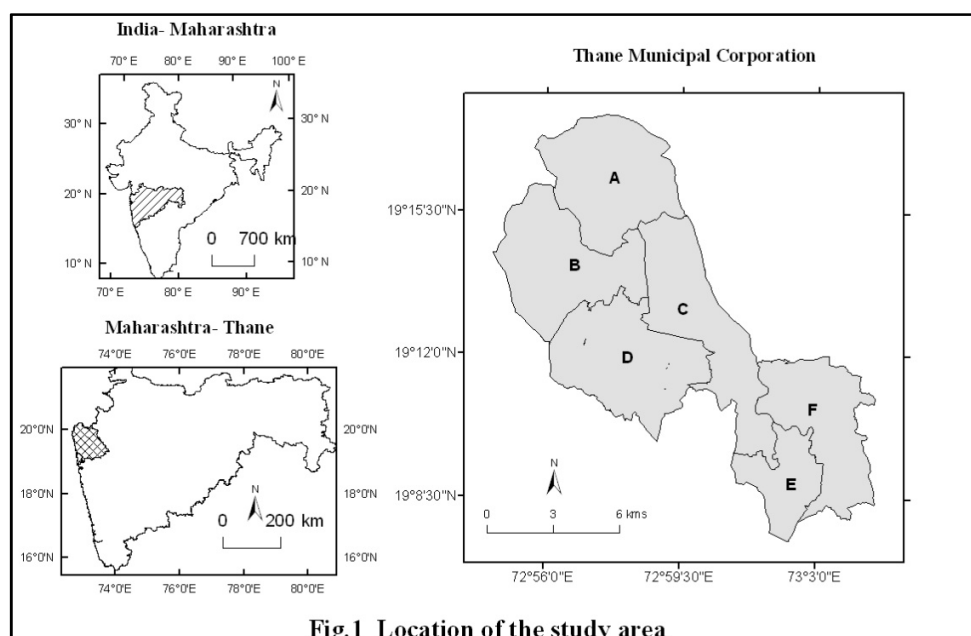
Thane city has many lakes and according to 2011 census report, its highest populous city in Maharashtra. In Thane city change a land use land cover (LULC) and increasing built up area which is affecting on water quality in Thane. Therefore, a systematic study was carried to assess the IS and its effects on water quality from 5 lakes in Thane.

2. Objective-

- 1) To extract impervious surface areas for Thane city and assess the growth of it.
- 2) To analysis WQI (water quality index) of selected lakes.
- 3) To correlate the ISA and Lakes water quality.

3. Study area-

Thane city is a part of the Mumbai Metropolitan Region. It is the administrative headquarters of Thane District, in Maharashtra. Thane is the first urban Center on the periphery of the Greater Mumbai and hence occupies a unique position in the region located at 19° 12' N and 73° 02' E. Topographically Thane is separated from the mainland by the Ulhas estuary and the Thane creek and it is connected through reclaimed land with the island city of Mumbai. The altitude is just 7 m above the mean sea level and the city is surrounded by hills towards the west and submersible marsh land along the Thane Creek on the south-east and Ulhas River bank towards the north. Because of the topography, there are many lakes in and around the city. The city is known for its lakes and has around 33 lakes within city limits. The location of the study area is shown in figure 1 and fig. 2.



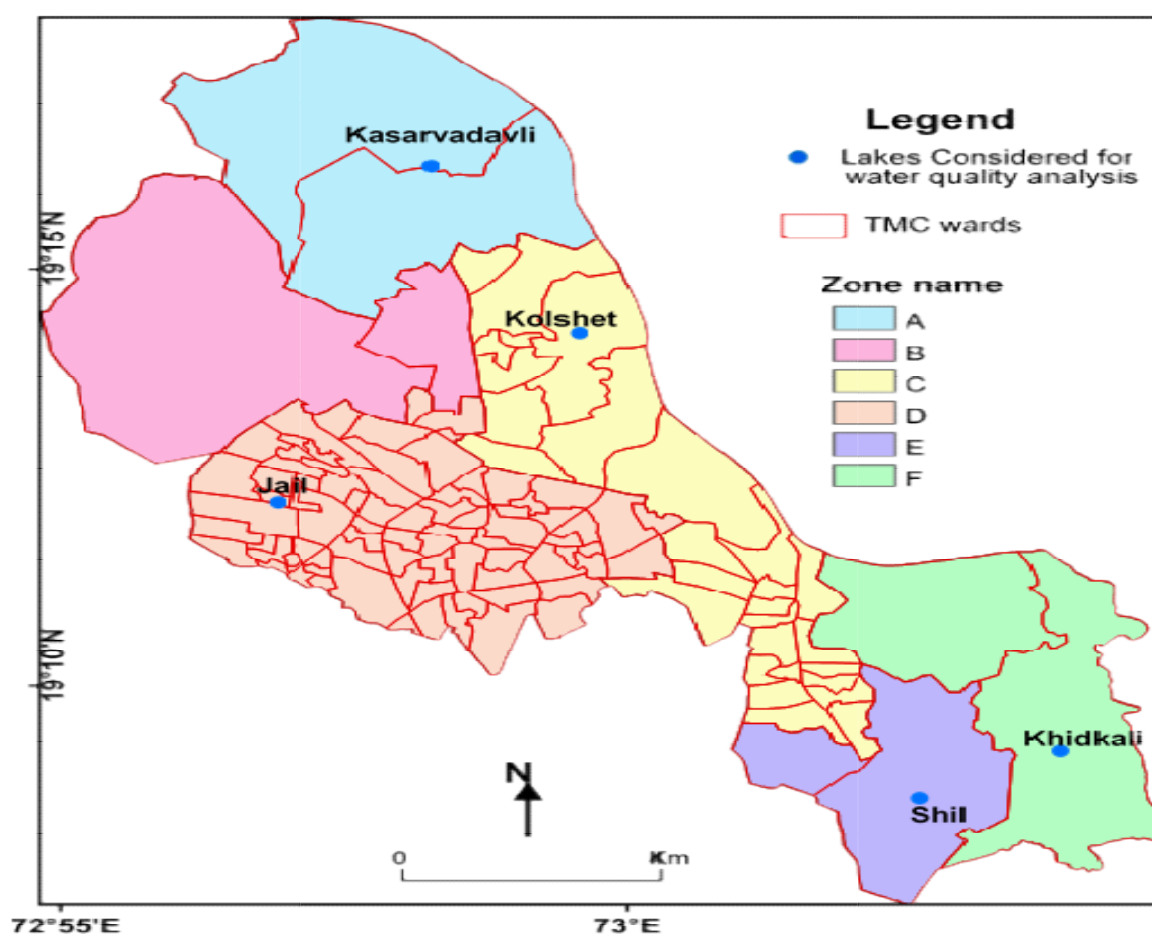


Fig. 2 Location of selected

4.Data

For extracting IS at decadal level (for year 1999 and 2017) Landsat 5TM and Landsat 8OLI+TIRS satellite data sets used and its downloaded from the earthexplorer site.

Administrative maps of Thane city were obtained from TMC website.

Kasarvadavali, Kolshet, Jail, Shil and Khidkali lakes are selected for to analysis of water quality for the present study. This lakes data for 2000 and 2018 obtained from Thane Municipal Corporation (TMC), Environment Status Reports (ESR).

6. Methodology

For the extraction of Impervious Surface Area (ISA), population calibrated impervious surface coefficients were calculated for the entire study area and methodology is adopted from Dhorde et al. 2012.

The model developed for extraction of ISA included nine independent parameters (4 band values, NDVI, TC band II, Slope, elevation, and population density) which were regressed against the dependent variable of percent IS. Using all these parameters a multiple regression model was built (equation 1) which was applied to all the images.

$$\text{Imperviousness (\%)} = a + b_1X_1 + b_2X_2 + b_3X_3 + \dots + b_nX_n \dots \dots \dots \text{eq. 1}$$

where, X_1 to X_n are the independent parameters

a , b_1 to b_n are constants

Water Quality Index (WQI) is a most effective tool to express water quality. Water quality index is a single unit less value that denotes overall water quality of a specific water sample. For the computation of lakes WQI NSF WQI (National Sanitation Foundation Water quality index) method was employed. The computation of Lake WQI was carried out in three steps by employing equations 2 to 6.

i) Relative weight of each parameter was computed by using the equation 2.

$$W_i = \frac{w_i}{\sum_{i=1}^n w_i} \dots \dots \dots \text{eq. 2}$$

Where, W_i = Relative weight

w_i = Assigned weight

n = number of parameters

- ii) Quality ratings (Q_i) were obtained for each of the individual parameter by taking a ratio of the measured value of the concerned parameter to the permissible limit of that parameter. The permissible limits were adopted as per the BIS standards.

$$Q_i = \frac{C_i}{S_i} * 100 \dots \dots \dots eq. 3$$

Where, Q_i = Quality rating of the individual parameter

C_i = Concentration of measured parameter

S_i = Permissible limit of the same parameter

- iii) Equation 4 represents the formula to be employed for obtaining the Q_i values for pH and DO.

$$Q_{pH,DO} = \left[\frac{C_i - V_i}{S_i - V_i} \right] * 100 \dots \dots \dots eq. 4$$

Where, C_i = Concentration of measured parameter

S_i = Permissible limit of the same parameter

V_i = Ideal value of the parameter

V_i for pH = 7.0 and V_i for DO = 14.6

- iv) The sub-indices for each parameter were computed by multiplying the relative weights with its respective quality ratings (eq. 5).

$$S_i = W_i * Q_i \dots \dots \dots eq. 5$$

Where, S_i = Subindex of each parameter

W_i = Relative weight

Q_i = Quality rating of the individual parameter

- v) Finally, from the S_i values obtained for all the parameters the final WQI value was obtained by simply summing up all the S_i values (eq. 6).

$$WQI = \sum_{i=1}^n S_i \dots \dots \dots eq. 6$$

Where, S_i = Subindex of each parameter

Table 1 Relative weights of water quality parameters (Lakes)

Parameters	Water quality standard*	Assigned weights (wi)	Relative weights (Wi)
pH	8.5	3	0.15
DO	4	4	0.20
TDS	500	1	0.05
COD	30	3	0.15
BOD	3	4	0.15
Nitrate	10	2	0.10
Phosphate	0.03	3	0.15
Chlorophyll	25	1	0.05
<i>*Water quality standards as given by BIS (CPCB)</i>			

6. Result

6.1) Growth in Impervious Surfaces-

Figure 3 illustrates the impervious surface areas (ISA) for Thane city in 1999 and 2017.

Almost there is 50% increase in mean IS from 1999 (40%) to 2017 (90%). In 1999, ISA values range between 30 to 70%, whereas in 2017 the maximum value of ISA has gone up to 95%. The imperious surface growth is observed along the major transportation arteries such as Ghodbandar road, NH-48, Kalyan road, Kalwa and Mumbra region. The growth in ISA is observed in D zone which is mainly old city area where ISA values ranges between 80 to 90%. The recent growth is observed in A and C zone due to proximity to Ghodbandar road in 2017 and ISA values are >60% which were earlier 40% in 1999. The zone B is occupied with the hilly tracts and vegetation which shows ISA <30%. Most of the part in zone F is under swamps and mud flats which denoted very low ISA in1999 (<30%). However, this zone also recorded increase in ISA (40-60%) along the Ulhas river side and Bhiwandi road, due to infrastructural development in 2017.

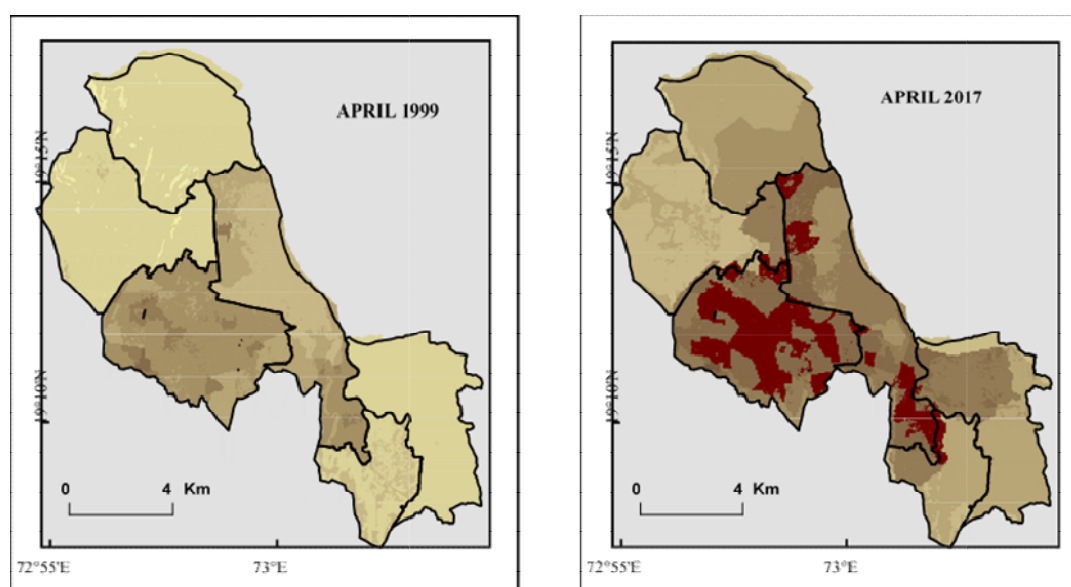
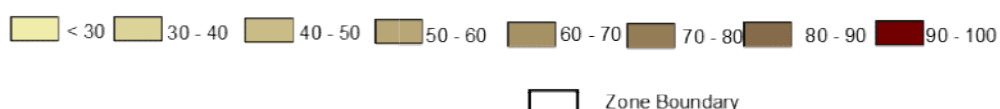


Fig. 3 IMPERVIOUS SURFACE AREA (%)



6.2) Lake water quality-

In present research work 5 lakes selected from each zone. The WQI obtained were further categorized in to five classes as mentioned in table 2. WQI for two benchmark year 2000 and 2018 are presented in figure 4. Interestingly, an improvement in the water quality of almost all the lakes, under consideration, is observed by 2018. Though the WQI for all these lakes again falls between 25 to 70 (i.e., Poor to moderate) class, overall increase in WQI from 2000 to 2018 signifies that there is slight improvement in the water quality of these lakes.

Table 2 Categorization of WQI (after NSFQI)

Water Quality Index	Remark	Colour
90-100	Excellent Water Quality	Blue
70-89	Good Water Quality	Green
50-69	Medium Water Quality	Yellow
25-49	Bad Water Quality	Orange
0-24	Very Bad Water	Red

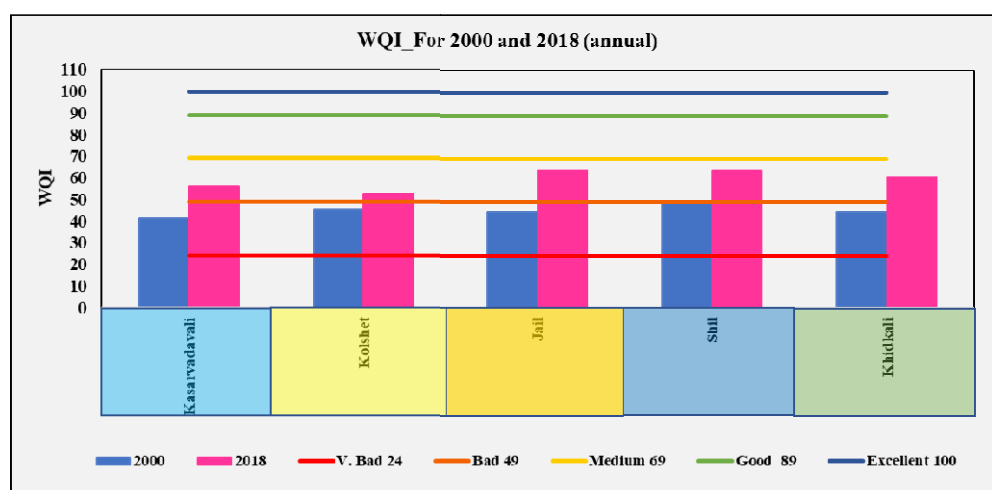


Fig.4 Variations in WQI for 2000, 2011 and 2018 of Lakes within Thane City

7. Conclusion-

In 18 years (1999 to 2017) study span observed increasing impervious surface area and built-up area speedily in all the zones. Most of the researcher observed, the surface bodies have deteriorated as a direct impact of increased IS. But in Thane Lake water, comparatively shows a trend towards improvement in the water quality in the recent period. None of the lakes however indicated a positive relationship between the water quality and ISA. This is primarily due to the cleanliness and awareness drive for lake water quality run by the TMC which has shown some improvement in the water quality of the lakes. The lake beautification, cleanliness and awareness drive for the lakes within Thane city can be cited as one of the best practices for maintaining the lake water quality even in a region with increased urbanization and impervious surfaces. Similar projects can be implemented elsewhere to help reduce pollution problems with major impounded water bodies. It is the need of the time to understand the direct impact of increased impervious surfaces within an urban region on the surface water bodies and act accordingly for their maintenance.

8. References-

1. Arnold C.L. and Jr, Gibbons C.J. (1996): Impervious surface coverage: the emergence of a key environmental indicator. *Journal of the American Planning Association*, Vol. 62, pp 243-258.
2. Booth, Derek B., and Lorin E. Reinfelt., (1993): Consequences of Urbanization on Aquatic Systems – Measured Effects, Degradation Thresholds, and Corrective Strategies. In *Proceedings of the Watershed '93 Conference*, Alexandria, Virginia, March 1993. pp 545-550.

3. Dhorde, A. A., Fernandez, R. B. and Dhorde, A. G. (2012): Impervious Surface Mapping for Pune city using Satellite data. *Golden Research Thoughts*, Vol.1, Issue.XI May 2012, pp 44-58.
4. Griffin, D.M. (1980). Analysis of Non-Point Pollution Export from Small Catchments.
5. Klein, R. D. (1979). Urbanization and Stream Quality Impairment. *Water Resource*
6. Schueler, T. R. (1987). Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs. Publication No. 87703 of the Washington Metropolitan Council of Governments.
7. Schueler, T. R. (1992). Mitigating the Adverse Impacts of Urbanization on Streams: A Comprehensive Strategy for Local Government. In *Watershed Restoration Sourcebook*. Publication N0. 92701 of the Metropolitan Washington Council of Governments, edited by P. Kumble and T. Schueler.
8. Schueler T.R. (1994). The importance of impervious surfaces, *Watershed Protection Techniques*, Vol. 1, pp 100-111.

An Ecocritical Reading of Water Stories From Around the World

Runa Shajeev

Dept. of English, Satish Pradhan Dnyanasadhana College, Thane

Abstract

Ecocriticism is a branch of literary theory that tries to identify and analyze environmental concerns that largely remain invisible on the surface. Fantasy stories have inspired people over generations in firing children's imagination and building a sound sense of ethics and values among them. What cannot be explained in a statement can be succinctly put across through stories. Raising ecological ethics and a sense of accountability to the environment can therefore be achieved through eco-literature i.e., environmentally oriented literature. This paper tries to explore how *Water Stories From Around the World*, a collection of allegorical stories for children, can be considered as eco-fiction that works as a model for creating environmental consciousness for conserving all life forms and water bodies in particular.

Keywords— ecocriticism, ecocentrism, deep ecology, eco-literature, water conservation

Ecocriticism, as a branch of literary criticism has rightly gained attention in critical studies due to its relevance and interdisciplinary nature. It is a branch of literary theory that tries to identify and analyse environmental concerns that largely remain invisible on the surface. The present paper tries to explore the ecocritical underpinnings in the short story collection *Water Stories From Around the World*, edited by Radhika Menon and Sandhya Rao.

Ecocriticism as an upcoming critical theory has nature as the subject of enquiry. In her pioneering work, *The Ecocriticism Reader* (1996), an important anthology of American ecocriticism, Cheryll Glotfelty, introduces the theory:

Simply put, ecocriticism is the study of the relationship between literature and the physical environment. Just as feminist criticism examines language and literature from a gender-conscious perspective, and Marxist criticism brings an awareness of modes of production and economic class to its reading of texts, ecocriticism takes an earth-centred approach to literary studies. (Glotfelty: xix)

Further, Don Scheese demonstrates the very essential view of ecocriticism which involves an integrated approach to the human and the non-human elements in the study of nature:

Ecocriticism is most appropriately applied to a work in which the landscape itself is a dominant character, when a significant interaction occurs between author and place, character(s) and place. Landscape by definition includes the non-human elements of place—the rocks, soil, trees, plants, rivers, animals, air—as well as human perceptions and modifications. How an author sees and describes these elements relates to geological, botanical, zoological, meteorological, ecological, as well as aesthetic, social, and psychological, considerations. And then there is the historical vantage point. As Thoreau once wrote, there can be no history but natural history—if one believes that by “nature” we mean the human as well as non-human world. (ASLE_Primer_DefiningEcocrit.pdf)

Charles Elton's remark in his work on animal ecology bears the indisputable truth about art. To lay claim to the role of nature oriented literature in developing ecological consciousness and fantasy stories in particular the renowned zoologist observes, "there is more ecology in the Old Testament or the plays of Shakespeare than in most of the zoological textbooks ever published!" (Elton 1950: 7) Stories have inspired people over generations in firing children's imagination and building a sound sense of ethics and values among them. What cannot be explained in a statement can be succinctly put across through stories. Hence, while discussing the purpose of fiction in creating ecological consciousness, Jim Dwyer states:

Why should one read fiction in addition to, or even in place of other forms? Garry Peterson notes that: how people use and relate to nature is determined in large part by the models, theories, and stories that people use to describe how human society and nature work. These concepts provide the mental infrastructure that underpins much of human action. Stories can help people reflect on their own models, and perhaps help them better understand their own ways of thought as well as those of other people. (Dwyer 2010: 6)

- The main agenda of Ecocriticism as a branch of literary criticism, therefore, happens to be the analysis of such environmentally oriented literature or eco-literature. Building such an ecologically conscious generation would stipulate understanding of the categorisation of eco-literature in the first place. Patrick D. Murphy terms eco-fiction as a related phenomena of:

"Nature oriented literature" and "environmental literature." According to Murphy, "Nature oriented literature is limited to having either nonhuman nature itself as the subject, character, or major component of the setting, or to a text that says something about human-nonhuman interaction, human philosophies about nature, or the possibility of engaging nature by means of or in spite of human culture." (qtd. in Dwyer 2010: 4)

Water Stories From Around the World, as eco-literature, is quite relevant for the present times for it dwells on the idea of fostering love and reverence for the gift of water, the singular quality that our planet is endowed with but often met with tacit disregard. It is a retelling of folklore and mythological fables from around the world that inspire care and regard for readers of all ages. Hence, environmental children's literature plays a pertinent role in creating awareness and understanding about the need to love and protect the environment as a gift not only for the present times but also for the future of the coming generations. Another advantage of fantasy stories is that they bring children closer to the idea of conservation without sounding too pedagogic and therefore banal. The manner in which writers of children's environmental literature approach environmental issues in unique ways that engage, gives them an edge over didactic ways of breaching the same subject. In the introduction to his thesis, *Animals are People Too: An Ecocritical Exploration of Fantasy in Environmental Children's Literature*, Dustin James Batty endorses the role of fantasy in children's literature:

Fantasy genre is useful to authors of environmental children's literature because its wide range of possible settings and characters offers a flexibility that allows authors to approach ecological issues in unique ways. Fantasy is a popular genre in children's literature because it engages both the intelligence and the imagination of its readers (Tatar 20). It is also useful as a method for introducing concepts that are unconventional in contemporary society because it "provide[s] intellectual and psychological distance and allow[s] us to critically explore that which we would not be comfortable exploring directly. (Batty 2016: 1)

For instance, the very introductory story, "Who Owns the Water" by Deepa Balsavar, reminds one of Vaikom Mohammed Basheer's Malayalam classic, "Bhoomiyude Avakasikal" ('The Rightful Inheritors of the Earth') which questions man's anthropocentric beliefs:

Anthropocentrism, [is a] philosophical viewpoint arguing that human beings are the central or most significant entities in the world. This is a basic belief embedded in many Western religions and philosophies. Anthropocentrism regards humans as separate from and superior to nature and

holds that human life has intrinsic value while other entities (including animals, plants, mineral resources, and so on) are resources that may justifiably be exploited for the benefit of humankind. (britannica.com)

Different animals in “Who Owns Water” contribute in the making of the muddy pit by unwittingly digging a hole that grows bigger and eventually fills with rain water. First, a little bird begins by unsettling a stone on the parched land to lay eggs; then, a boar tries to get comfortable and fit himself into the small hole; next, a pack of wild dogs dig deeper to look for dinner; and some buffaloes wallow in the puddly water: all contributing in the formation of the water body, bit by bit. This wetland flourishes and the grass around the wetland grows greener. A variety of life forms thrive in it. However, toward the end, it is a selfish man who decides to be its owner.

Needless to say, one is forced to ponder over the agonising but legitimate question about the rightful owners of the earth. The narrative structure of the story—an adult answering the obvious questions of a child—rightly reminds one of the anthropocentric or human-centred attitude and selfishness of mankind. The rationale working at the core of the story is that just because one can commercially dispose nature one is not the only inhabitant of the earth. Although compiled for children, the entire collection can be considered as an anthology that asks serious questions to the adult readers as well. Man has come to think of nature as nothing but a commodity to satisfy human needs. The story ends on a very serious innuendo, “Who owns the water?” Not a moral, just a thought—a germ of an idea to dig and make bigger. (Menon 2010: 9) This signifies the anthropocentric attitude of man who believes that everything in nature centers on his benefit.

There are a number of key concepts around the theory of Ecocriticism. The first of which is anthropomorphism: the practice of giving animals and other elements of nature, humanlike qualities. Anthropomorphism is an essential part of allegorical fiction. To signify the importance of anthropomorphism in ecocriticism, Christine Battista says that “The entire movement of ecocriticism is distinctly predicated on...the need to give agency to the nonhuman world” (Batty:158)

“House of Sun and Moon : A Story from Nigeria” by Amruta Patil is one such anthropomorphic story among many, in the collection. It describes the creation of Earth, the lovechild born out of the marriage between the Sun and the Moon. It narrates the love and labour that goes into the making of the blue planet and everything marvellous in it. Although symbolic in nature, every part of the narrative appears true to the child reader. Anthropomorphic characterisation of the story is apparent in the celestial bodies in nature. Like, the sun, moon, stars, asteroids, planets, satellites, meteors, water bodies, geese, and even the sunflowers participate in celebrating the special day. However, it upsets the parents when Water and her children do not show up for the party. They try to find out the reason behind the absence and this becomes the central idea of the story—the contribution of different water bodies on earth. On being chided by the Moon, Water helplessly tries to convince the Moon about the enormity of the challenge posed by her to accommodate the surface of the sun and the moon and her responsibility toward her offspring. However, Moon is relentless and Water gives in. She gathers all her children, ie., all the water bodies and readies to visit the house of the Sun and the Moon. Moreover, all the species that thrive on water bodies join together. The following passage provides insight into the myriad roles of Water:

Water set about gathering all her children into her apron, so none would be left behind to parch, and die while she was away. It was complicated job...and it took all day. Carefully, water scooped up her trailing blue-green skirt, and started her long journey towards the house of Sun and Moon. As she made her way up, oceans, seas, glaciers, rivers, streams, brooks, lakes, ponds and puddles all joined in. Every seaweed and shrimp and lotus and porpoise and turtle and plankton and fish and seal and crab and sea snake and mangrove joined the watery parade—not to mention a million others you wouldn’t know on first name basis...” (50-51)

Metaphorically speaking, the outcome of the sojourn proves the prodigious power of the mighty Water. Everything in sight is washed away by the sheer power of the waves that crash into the home of the Sun and the

Moon; thus signifying the role of water bodies. The story ends with the quote, “And needless to say, Sun and Moon never underestimated Water’s responsibility again.” (52)

“The Green Man: A Story From Many Myths” by Mariam Karim-Ahlawat is another fable about the founder of Water of Life which gives him immortality. He is the ruler of monsoon and rides on a fish. Once Sikandar with his advisor Al-Khizr, decides to travel beyond all seas in search for the “Fountain of the Water of Life”. Sikandar is an ambitious emperor who wants to conquer the world and become the partner to Allah. He wishes to find the Water of Life that will make him immortal. He gets restless with his wazir Al-Khazr for his advisor does not tell him anything about the Water of Life. However, as they cross the desert, they come upon a path that leads to a pool that sustains all forms of life. Eventually, he understands the true meaning of immortality as he encounters the life sustaining quality of water that nourishes all life forms on this planet. So the author maintains the true meaning of immortality by implying, “This continuity of life on earth, surely, is the true meaning of immortality. The Continuity of a Green World, therefore, the Green Man!” (22) Which is the bedrock of the ecocentric thought. Hence, this story brings forth the idea of water conservation, quite aptly.

Further, in the ecocritical thought, Deep ecology is a social movement that discusses the need for ecological wisdom. Arne Naess, the founder of the philosophical movement established the need to recognise the inherent value of nature irrespective of its utilitarian value to the human species:

During the early 1970s, Naess suggested that the environmentalist movement needed to do much more than conserve and protect the environment. He held that a radical re-evaluation of the understanding of human nature was needed. In particular, he claimed that environmental degradation was likely due to a conception of the human self that had been ill defined in the past. Naess argued that the individual is cut off from others and their surrounding world when the self is seen as a solitary and independent ego among other solitary and independent egos. That separation leads to the pitfalls of anthropocentrism and environmental degradation. He believed that a new understanding of the self (called “self-realization”) was needed.” (britannica.com)

Several stories reiterate the need to develop the value of regard towards all beings of nature; and the need for unity and wellbeing of all the species which is in accordance with the philosophy of Deep Ecology. For instance, Zai Whitaker, a well known nature conservationist's story, "Selekana and the River Goddess: A Story from Botswana" uses the fantasy trope to prove the power of nature and the need to conserve natural resources, thereby emphasising the need to nurture human values which is in tune with the deep ecological thought. The village of Botswana is facing a drought and the people keep looking for answers. The river goddess gifts Selekana the bounty of the river due to her kind nature which saves them in the end. By letting Selekana the choice of exploiting the bountiful resources in the river, the story also hints at eco-ethics i.e., ethical choices one makes with regards to nature for conserving the very many species of plant and animal life that depend on the river for its sustenance.

Similarly, "Koluscap and the Water Monster: A Native American Story" by Sowmya Rajendran tells the story of a selfish village chief who refuses to share the water of the stream with the villagers by building a dam on it. The villagers try to reason with him, beg and plead but lose their fight with him. Finally, with the help of a great spirit Koluscap, they are able to demolish the dam and release the water; thus defeating the selfish motives of the chief.

Likewise, "Tiddalik the Frog: An Aboriginal Story From Australia" by Suniti Namjoshi is another fable about a selfish little frog, Tiddalik, who drinks the entire water on his land and grows bigger and bigger. Although he is ashamed of himself in the beginning, he gradually becomes shameless and more selfish and turns a deaf ear to their plea. The kookaburra believes that if the frog is made to laugh, some water will spill out. However, despite all his efforts Tiddalik does not budge. Then an emu decides to dance to make Tiddalik laugh but he too fails. The kangaroo decides to tell a funny tale to make him laugh, but fails in his effort to make him laugh. The eel tries acrobatics and accidentally falls on the frog's enormous body. As he slides down his huge slippery body, the frog is tickled into laughter; thus flooding the entire land with water once again. Only, this time all the creatures rush into a canoe to save themselves from the deluge. However,

Tiddalik is left out due to his enormous size. This is yet another fable that reiterates the importance of sharing natural resources equally. Similarly, “The Hero Twins and the Swallower of Clouds: A Native American Story” by Suniti Namjoshi is a parable about the twin heroes who fight a cloud swallowing giant. They seek the assistance of a spider to kill the giant who poses a threat to the entire village. All the above stories address the value of nurturing and selfless sharing of natural resources on earth.

Native ecological wisdom is an oft repeated theme in the ecological thought. “A Well is Born: Story From India” by Radhika Chadha is a ballad that celebrates indigenous ecological wisdom. The ways of the indigenous demonstrate remarkable ecological wisdom. “Indigenous knowledge is the knowledge acquired by the native people through the accumulation of experiences, informal experiments and intimate understanding of their environment in a given culture.” (Rajasekaran, B. and D.M. Warren. 1993). In Chadha’s ballad, a water-starved village is promised a well by the sophisticated engineer. The promise of this life-giving liquid lends hope and happiness to their otherwise parched existence. The women dream of freedom from the excruciating task of fetching water from miles away; the men daydream of famine-free farms, of better yields and protection from delayed rains. They are promised of this miraculous well by the end of the day. The anticipation keeps building as the drill bores into the ground. However, despite his expert opinion, he fails to find water and decides to try again, the next day. This drilling continues in a new spot everyday but they fail to find any water. Finally, after a failed third attempt, a farmer points at an anthill and suggests that they could find water in the anthill as he has always found the anthills moist. Finally, they do find water after drilling near the anthill and the engineer is surprised at the knowledge of a simple villager. All his expertise in engineering technology had failed him. The ballad ends on a positive note that there is a need to synthesise the knowledge of the past and the present for a better world. The following stanzas aptly illustrate the source of ecological wisdom present in native culture:

Where did you get this amazing knowledge?

I didn’t realise you’d been to college!”

The old farmer smiled and said, amused,

“I don’t blame you for feeling confused.

If you want tips on how to find water,

I’ll tell you the verse in the Brihat Samhita.

I recommend this ancient treatise

written by Varahamihira, the wise.”

It’s all about observing life you know,

where insects live, how the trees grow,

If to nature’s clues we pay careful heed,

the secrets of the earth are quite easy to read. (44)

“Tribute for a King: A Story From Greece” by Sandhya Rao is the tale of a hypothetical interaction between the Alexander the Great, the ambitious conqueror of lands and Poseidon the king of the sea. Having conquered the land, the imperial king moves into the sea more ambitiously. The following lines demonstrate his imperialistic tendencies: “I was saying I rule the land, and now I shall rule the waters. Kneel, Poseidon, and pay me rich tribute.” (75) However, he is lost and laughed at by the sea creatures that make him appear ludicrous in comparison to his powerful image over the land. The king from the sea seeks to know why he should kneel in front of Alexander. Alexander tries to convince the king by claiming his great skills of taming a wild horse but this does not satisfy Poseidon. Hence, he continues to persuade Poseidon of his greatness by naming his tutor Aristotle but this too does not help. By and by, Alexander continues by claiming his special abilities in accomplishing the most challenging of all tasks; the untying of the Gordian knot. Finally, after failing to persuade Poseidon to kneel, Alexander’s persistence wins him some favour and he is given a box to fill up something from the land. Poseidon promises to kneel before him if he is able to get something from land. Alexander does not find the task very challenging but is proven wrong. Every time he tries to fill something in the box, it turns empty. Water, sand, stones, pebbles, everything vanishes from the box. Finally, Alexander

accepts defeat and visits Poseidon. However, what Poseidon conveys to the conqueror of the land, constitutes the crux of the ecocentric philosophy. When he realises that there is no need to dominate by adopting a man-on-top position but to integrate with nature, the box is filled with the amazing sea and everything in it. This is the underlying contention of the egocentric versus the ecocentric man in the ecocritical thought. The following lines demonstrate the ecocentrism embedded in the collection of stories. Alexander confesses:

“Here,” he said, holding out the empty box to the king of the seas. “I have failed. The waters can never be mine for I have failed to fill this box with anything. Nothing stays!” “Oh but you are wrong.” returned Poseidon. “For one, the waters are not mine either. I am only king, the man in charge. For another look!” And he thrust the box forward. Alexander saw that it was filled with innumerable sea creatures of many shapes and colours swishing merrily in and out, in and out, until finally the box disappeared altogether and only the water with its teeming life remained. He smiled. He understood.” (80-81)

From the ecocritical point of view, “Tribute for a King: A Story From Greece” fairly holds the answer to the present predicament of the natural environment. There is this need for mutual respect and recognition of the intrinsic bond between man and nature. Once this connection is conceived, there will be less need to dominate and abuse nature.

To conclude, one can say that despite the cultural differences in the origin of these fables, they effectively promote the ecocentric thought in children. These fables can influence the perceptions of the young minds about the nonhuman world by reiterating Barry Commoner’s dictum, “Everything is connected to everything else.” (Commoner: 48) Moreover, children’s fantasy literature can strengthen this ecocentric thought by engaging them in a manner that pedagogy may not and make them see the connections otherwise oblivious to the human eye. As Rachel Carson, the great biologist and the mother of the western environmental movement rightly opines, “The more clearly we can focus our attention on the wonders and realities of the universe about us, the less taste we shall have for destruction.” (Carson: 28) Accordingly, these fables clearly garner children’s attention to the

wonders of nature and raise ecological consciousness in conservation of all life forms and water bodies in particular.

Primary Source:

Menon, Radhika and Sandhya Rao Eds. *Water Stories From Around the World*. Tulika Publishers: Chennai, 2010. Print.

Work Cited:

- Basheer, Vaikom.Muhammad *Bhoomiyude Avakashikal*.Kottayam: D.C.Books 2017. Print.
- Battista, Christine. “Ecofantasy and Animal Dystopia in Richard Adams’ Watership Down.” *Environmentalism in the Realm of Science Fiction and Fantasy Literature*. Ed. Chris Baratta. Cambridge Scholars P: Newcastle, 2012. 157-67. Print.
- Batty, James. Dustin. *Animals are People Too: An Ecocritical Exploration of Fantasy in Environmental Children’s Literature* University of Northern British Columbia PhD Dissertation. <https://arcabc.ca/islandora/object/unbc%3A17303/datastream/PDF/view> 2016.
- Carson, Rachel *Silent Spring*. Mariner Books Boston New York: 2002 ePub.
- Commoner, Barry. *The Closing Circle: Nature, Man, and Technology*. Dover Publications: Minnesota New York 1971
- Curry, Patrick *Ecological Ethics an Introduction*. Polity PressUK: 2011. Print.
- Dwyer, Jim. *Where the Wild Books Are: A Field Guide to Eco-Fiction*. University of Nevada Press: Reno and Las Vegas, 2010. Print.
- Elton, Charles. *The Ecology of Animals*. Dunfermline:Sidgwick & Jackson,1950.
- Rajasekaran, B. and D.M. Warren. 1993. “Indigenous Rice Taxonomies and Farmers’ Rice Production Decision-Making Systems in South India.” In D.M. Warren, D. Brokensha, and L.J. Slikkerveer, (Eds.), *Indigenous Knowledge Systems: The Cultural Dimensions of Development*. London: Kegan Paul International.

Internet Sources:

- <https://www.britannica.com/topic/anthropocentrism> (viewed on 23rd January 2021)
- http://www.asle.org/wp-content/uploads/ASLE_Primer_DefiningEcocrit.pdf(viewed on 24th January 2021)
- http://research-chronicler.com/reschro/pdf/v6i1/6104-Runa-the_inheritors_of_the_earth.pdf(viewed on 25th January 2021)
- <https://www.britannica.com/topic/deep-ecology>(viewed on 26th January 2021)

Sustainable Development of Nandur Madhmeshwar Wetland for Health and Food

Keshav Gangurde

Dept. of Chemistry, VPMK's, Arts, Commerce & Science College, Kinhavali, Tal.- Shahapur, Thane, (M.S)
India, 421 403.

Abstract

The importance of Nandur Madhmeshwar wetland for health and food sustainability is focused in this study. It is located on the confluence of the Godavari and the Kadava Rivers in Nasik district of Maharashtra. Many biological species have been found to depend on this wetland for their food and shelter. This is the first Ramsar wetland in the Maharashtra state and among the 42 in India. It is one of the beautiful bird sanctuary and place with biological diversity in Maharashtra.

Keywords: Nandur Madhmeshwar Wetland, Food, Crop, Irrigation.

Introduction

Wetlands are the areas on the earth where land is covered by water. It is like a junction between aquatic and terrestrial ecosystem. It provides habitat and food to amphibians, aquatic plants, birds, fish, insects, mammals, microorganisms, reptiles and supports a wide diversity of life. Therefore, wetlands when compared with rainforests and coral reefs are the foremost profitable biological system within the world. Wetlands can be natural and manmade and are usually found in low-lying regions. Mainly they are classified into two categories tidal and non-tidal wetlands. They can be the coastal and inland flood plains, marshes, deltas and lakes. Wetlands can contain freshwater or saltwater depending on the origin. During breeding and migration, animals especially birds depends on wetlands for water and food. Wetlands improve quality of water by filtering out sedimentation, decomposing vegetative matter and absorbing pollutants present in the water. The ground water level is increased by wetlands through recharging. Siltation through wetlands improves soil fertility. Wetlands also provide subsistence sources to humans in terms of Agricultural produce, craft materials, Timber production, medicinal plants, fishing and hunting.

Keeping all above notable benefits of wetlands in mind, the present study addressed Nandur Madhmeshwar wetland for health and food sustainability. It is inland, man-made wetland located in the area of 11 Villages namely Chapadgaon, Dindori, Karanjgaon, Katargaon, Khangaon-Thadi, Kothure, Kurudgaon, Manjargaon, Nandur Madhmeshwar, Pimplas and Shivare near Niphad Tehsil in Nashik District of Maharashtra State, India. In the year 2019, the international Ramsar convention on wetlands declared Nandur Madhmeshwar wetland as Ramsar wetland.¹ This is the first Ramsar wetland in the Maharashtra state and among 42 in India. The surrounding water bodies, vegetation, scrub and tree cover makes this wetland a shelter for 105 water bird species, 21 freshwater fish species and 41 butterfly species.^{2,3,4} It is one of the important bird areas and place with biological diversity in Maharashtra.

Description of the study area

The Nandur Madhmeshwar wetland is located on the confluence of the Godavari and the Kadava Rivers in Nasik district of Maharashtra. It is located between longitude 74°2' to 74°10' and latitude 19°59' to 20°4'. It is 40 km away towards east of Nashik district and 9.6 km away from Niphad Tehsil (Fig. 1).

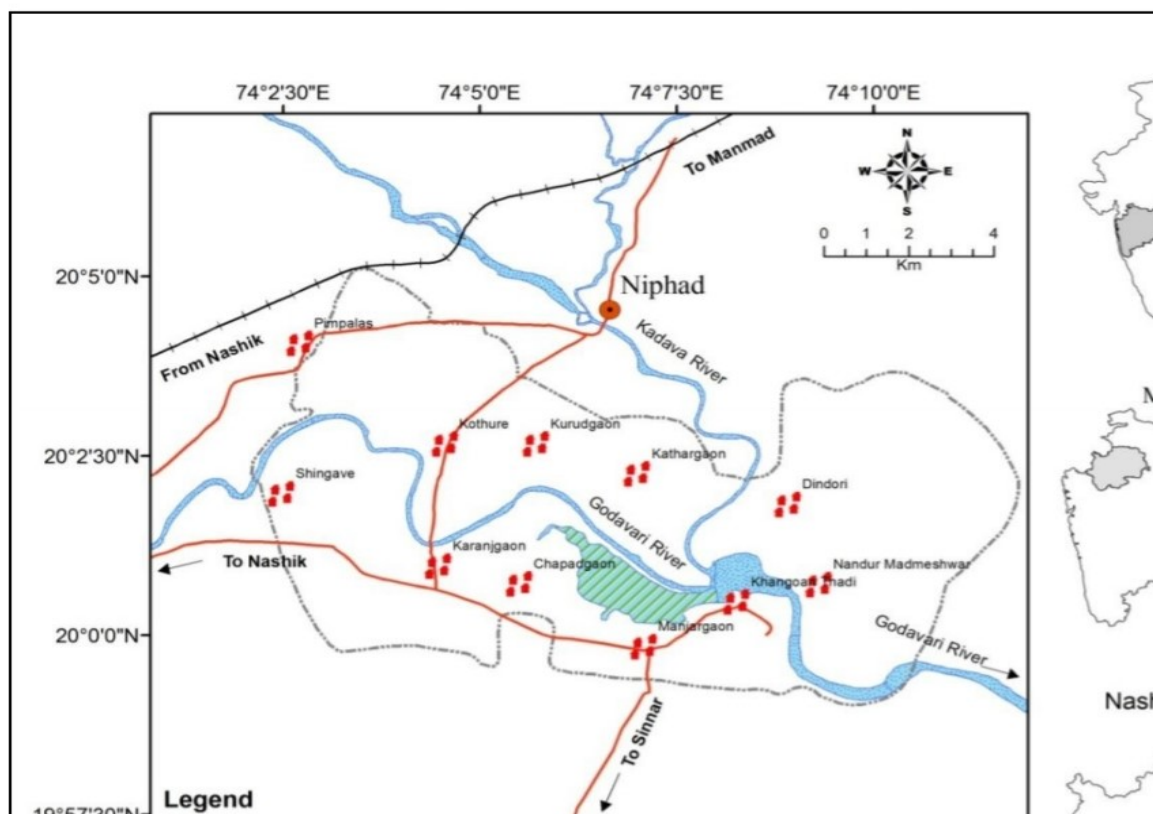


Fig. 1: Location map of Nandur Madhmeshwar Wetland

Ecological status of the Wetland

Agricultural lands in the nearby villages of this wetland are being cultivated, predominantly with sugarcane (Fig. 2).



Fig. 2: Agricultural development around Nandur Madhmeshwar Wetland.

In the past years cultivation of cash crops like grapes, onion and sugarcane increased the economic status of farmers in the surrounding area. The farmers of Ahmednagar and Aurangabad benefitted through irrigation also found economic change in their life. The reservoir has a variety of aquatic animals like fishes, crabs, snails, prawns, which resulted in another economic Fishing activity.

Food and Health Sustainability

In the year 1916, Nandur Madhmeshwar wetland was formulated by constructing a weir on Godavari River immediately below the confluence with Kadava River to supply water for irrigation. The scarcity of drinking water faced by the people from Ahmednagar and Aurangabad district gets fulfilled due to this weir and wetland. The water is released through the three canals of weir for this purpose. Due to continuous deposition of silt and organic matter in the Nandur Madhmeshwar wetland in the past years, the water level of the wetland has become shallow and resulted in formation of islands and ponds. The agricultural land surrounding to this wetland has become more fertile due to continuous deposition of silt, which enriches the biodiversity and stabilizes the vegetation in and around the water body. Many biological species have been found to depend on this wetland for their food and shelter.^{2,3,4} Every year the number of migratory birds visiting this place is found to increase and it attracted nature lovers and bird watchers. The major migratory species are Cranes, Ducks, Flamingos, Ibises, Storks, and Waders.² The terrestrial animals like Civet cat, Jackal, Jungle cat, Leopard, Mongoose, Rabbits, Wolf, and many species of Snakes have been seen often by the people of nearby villages. The aquatic plants are found to be abundant in this wetland. The shallow water ponds are rich in algae and it is the food for a number of Waders.

The sunrise & sunset, the flocks of thousands of migratory & local birds during the winter season make the wetland beautiful sight and increase its aesthetic value.² In the past years, the spread of any epidemics or noticeable diseases have not occurred so far in the nearby villages of the Nandur Madhmeshwar wetland. During the winter season the entire wetland gets covered with colorful avian fauna creating a healthy climate for tourists.

Conclusion

The Nandur Madhmeshwar wetland is found to be biologically rich with a diverse variety of aquatic and terrestrial plants species, mammal species, bird species, freshwater fish species and butterfly species. All the biological species in and around this wetland have been found to depend on it for their food and shelter.

Literature Cited

1. Quadros G. Sarovar Saurabh: ENVIS Newsletter on Wetland Ecosystem including Inland Wetlands; 2020; 16(3).
2. Chavan S., Kulkarni A. & Jadhav P. Birds & their conservation status at Nandur Madhmeshwar bird Sanctuary near Nashik, India. International Journal of Fauna and Biological Studies; 2018; 5(4): 109-119.
3. Wagh P., Kurhade S., Jadhav S., & Jaiswal D., Fish fauna of Nandur Madhmeshwar Wetland, Maharashtra, India. Journal of Threatened Taxa; 2018; 10(7): 11973.
4. Kurhade S. & Wagh P. Butterflies of Nandur Madhmeshwar Wildlife Sanctuary, Maharashtra (India): Part-I. Journal of Basic Sciences; 2015; 88-93.

Review: “New perspectives on climate change”

¹V.R.Bagul, ²Dr.R.P.Chavan

¹Assistant Professor, ²Associate Professor

¹MGV’S Arts, Science and Commerce College Surgana, Dist-Nashik, India

²Satish Pradhan Dnyanasadhana College, Thane

Abstract: Probably the most profound problem ever faced by human social, political, and economic processes is climate change. Our climate is shifting and this will impact all sectors of the planet. In both industrialized and emerging countries economy. To plan for the consequences of climate change, confusion about the future need not be an obstacle. Some components of the environment are better understood than others, but both are subject to certain uncertainties. This thematic paper examines the current and future global situation of water, climate change and water scarcity in terms its causes and their impacts on environment, food security and natural resources of water.

Keywords: Climate Change, water crisis,

Introduction

Water is most essential component of life however; water quality is continuously declining due to increased anti-environmental human activities and certain natural processes and poses a great danger to all forms of life, including humans. The main cause of the spread of many epidemics and some serious diseases such as cholera, tuberculosis, typhoid, diarrhea etc. is contaminated water. Water is the basis of life and livelihoods and is important to sustainable development. Despite this, water is becoming a pressing societal and geopolitical problem – in some areas, it is already of National issue. Since the 1950s, global demand for water has tripled, but fresh water reserves have fallen by half a billion. People live in countries that are water-stressed or water-scarce, and by that number will rise to three billion in 2025 because of an increase in a populace. The main consumer of water is irrigated agriculture, approximately 80 percent of global water consumption accounts for it.

Climate change and its impact on water scarcity

It is true that water is abundant, covering 70 percent of the earth, but only 2.5 percent of all is drinkable water it’s not just the population that puts water supplies under pressure. Often, inappropriate usage is obvious: In the 20th century, the global population tripled, but water use increased by the 6-fold. Water demand is projected to rise by 400 percent from now to 2050. Manufacturing and household use by 130%. Various water conceptualizations can have led to conflict. The view of water as a human right and a collective public and environmental good is often opposed by the view of water as a product to be priced in

order to ensure that it is used safely and sustainably. It will involve not only states, but provinces and communities.

Increase water scarcity due to changes in precipitation patterns and intensity. In particular, the subtropics and the mid-latitudes, where most of the world's poorest people live. Populations are expected to become significantly drier decrease the storage capacity of natural water from the melting of glacier/snowcap, and subsequently reducing long-term availability of water

The capability and reliability of the water supply system are impaired by storms, severe weather and the increase in sea level. Many current water treatment plants and distribution systems have not been designed to withstand the projected rise in sea level and the increase in extreme weather due to climate change. An international scientific consensus exists that global climate change is already taking place. This is indicated by the warming of our atmosphere and seas, followed by rising sea levels and shifts in the global patterns of weather. The Climate Change Committee states that there is a high degree of trust that increases in greenhouse gas concentrations, mainly due to human emissions, have led too much of the warming since the mid-20th century has been observed.

Effects of Climate Change on Natural Resources:

Environmental conditions for humans and animals are threatened by climate change. Climate change impacts wildlife populations both directly and indirectly, as a result of changing environmental factors. The atmosphere of the Planet includes differences in a complex structure of which several other parts communicate with the atmosphere. Oceans, sea ice, and land and their characteristics are the other elements of this climate system. Water is a key component of Climate environment, and in many forms: snow cover, land ice (glaciers included) Antarctica and Greenland's large ice sheets), rivers, lakes, and surface and subsurface Aquatic Water. Many of the foregoing activities produce results that are comparable to the natural forces that are influencing the environment. Changes in the use of land through operations like Deforestation, development of towns, storage, the use of water and the use of resources are all known to be important considerations locally. Adding another layer of climate change of complexity. By 2050, the global human population will surpass a record 9 billion people.

Conclusion:

Climate change can not necessarily be anticipated, by only using numbers and findings. They are too difficult or go way beyond situations that has ever existed before. Debate on global shortages of water and food security has escalated. And, in recent times, reliable forecasts of potential demand for water and food are elusive. The analysis showed that rising demand for food and water would increase population and income growth. Irrigation will be the first sector to lose water as competition for water increases through non-agricultural use and water scarcity intensifies. Increasing water scarcity will have consequences for food security, hunger,

poverty, and the health and services of the ecosystem. In terms of the weather, weather sequences, and extremes that might occur, there is a great need to be able to better translate what climate changes may mean, so that these can in turn be translated into impacts on different sectors of society and human activity.

REFERENCES

1. Munir A. Hanjra ,M. EjazQureshi. Global water crisis and future food security in an era of climate change Food Policy. 35 (2010) 365–377
2. Goddard et al. Earth Perspectives .2014, 1:10
3. Towards Sustainable Flood Risk Management Int. J. Disaster Risk Sci. 2010, 1 (1): 33-43
4. IlanKelmanet.al. Climate Change’s Role in Disaster Risk Reduction’s Future: Beyond Vulnerability and Resilience.Int J Disaster Risk Sci(2015) 6:21–27
5. .Andrea Ferraz YoungAdaptation actions for integrated climate risk management into urban planning: a new framework from urban typologies to build resilience capacity in Santos (SP) Young City TerritArchit(2016) 3:12
6. Lepane et al. Impact of seasonal climate change on optical and molecular properties of river water dissolved organic matter by HPLC-SEC and UV-vis spectroscopy Chemical and Biological Technologies in Agriculture (2015) 2:14
7. . Hosseinizadeh et al.Impact of climate change on the severity, duration, and frequency of drought in a semi-arid agricultural basin Geoenvironmental Disasters.(2015) 2:23
8. Riffat et al.Future Cities and Environment (2016) 2:1
9. Peijun Shi et.al. World Regionalization of Climate Change (1961–2010) Int J Disaster Risk Sci(2016) 7:216–226
10. . Paola Viganò Extreme Cities and Bad Places Int. J. Disaster Risk Sci. 2012, 3 (1): 3–10

Conservation of Wetlands for Sustained Food Security and Health: A reflection.

Purushottam G. Kale,

Retired Professor and Head, Department of Zoology, Ramniranjan Jhunjhunwala College, Ghatkopar, Mumbai
400086. pgkale@gmail.com

Abstract:

Wetlands, world over, are responsible for maintaining fertility of soil and moisture in the soil, thus supporting agriculture as well as biodiversity. It has been unfortunate that the ecosystem services of these ecosystems have been ignored for several centuries and with increasing human populations, these have been considered as wastelands causing either their loss or irreparable damage.

Wetlands possess a great potential of supporting several of the goals of sustaining biodiversity, including a vast variety of medicinal plants, as well as agriculture, horticulture, animal farming and aquaculture for health and food security. Human civilizations have prospered in the river valleys and in the vicinity of other freshwater resources for the same reasons. Though the wetlands have fulfilled the basic needs of man, the greed has resulted in their degradation in all parts of the globe. Increasing population has necessitated an increase in rigors of food production, industrialization, and urbanization, taking toll on the wetlands.

Post-Ramsar convention, the importance of the wetlands is being understood, researched and appreciated in all countries and there has been initiation of wetland conservation practices. The National Plan for Conservation of Aquatic Ecosystems (NCPA, 2013) has been working towards the conservation of wetlands at large and freshwater wetlands in particular. The Indian Space Research Organization has already started the collection of data on the location, boundaries and zone of influence of wetlands in the country. Wetlands (Conservation and Management) Rules (2017) provides notifications that need to be implemented strictly to achieve successful conservation of freshwater wetlands. The local, state and central administration should intensify the efforts towards protection and conservation of freshwater wetlands to safeguard the sustained health and food security.

Freshwater Wetlands

Though coastal and inland saline wetlands are as significant a part of wetlands, from the view point of food security and health, freshwater wetlands are way more important. They include the Ramsar listed wetlands including the freshwater lakes and reservoirs from Gujarat eastwards through Rajasthan and Madhya Pradesh; the freshwater marshes of the Gangetic Plains and the floodplains of the Brahmaputra; the marshes and swamps in the hills of northeast India and the Himalayan foothills; the lakes and rivers of the mountain region of Kashmir and Ladakh and other freshwater bodies yet to attain Ramsar status as well as the smaller bodies that can never qualify to be Ramsar sites. Many of these wetlands are directly or indirectly linked with major river systems like the Ganges, Cauvery, Krishna, Godavari and Tapi. India has a total of 27,403 wetlands, that include 23,444 inland wetlands and 3,959 coastal wetlands (Bassi et al., 2014, vikaspedia). The Directory of Asian Wetlands (1989), has established that excluding rivers the wetlands occupy 18.4% of the country's area, of which 70 % wetlands are under paddy cultivation. Of the estimated 4.1 mha of wetlands in India, (excluding irrigated agricultural lands, rivers and streams), 1.5 mha are natural, while 2.6 mha are manmade (Bassi et al. (2014). In south India, the manmade "yeries", in almost every village and the backwaters of small and large dams in different states, not only supply water for human needs but also support a diverse flora and fauna. The ecosystem services these wetlands provide have been discussed by many workers (Fisher et al., 2009; Carter, 2013 & 2015; Madhyastha et al., 2000)

Threats to freshwater wetlands

Grzybowski and Glińska-Lewczuk(2019) and Oshimaya (2021) have recently summarized the major threats to wetland ecosystems around the world. Due to the unpredictability of rainfall, infertility of soil and several related problems, there has been a steady migration of people from highlands towards the freshwater wetlands generating pressure on them (Barber, 2007). Though there is assured water supply and availability of fertile soil, excessive use of fertilizers and pesticides have caused eutrophication and rapid aging of the freshwater bodies (Joseph, 2016; Dhavan, 2017).Rapidly growing urbanization, deforestation, pollution, salinization, acidification, intensive aquaculture practices, introduction of new species and climate change have been the major causes of decline in number, expanse and quality of the freshwater wetlands (FAO, 2011, Wetlands and Agriculture, Report by Australian Government, 2016).

Wetlands and health, Food Security Paradoxes

Our National Anthem boasts that our land is fertile and with abundance of water but unfortunately the land is fast travelling towards perpetual drought and infertility. The country has already lost its 50% freshwater bodies (Chandra et al., 2018).Bouton (2019) and Todhunter (2019) have reported the paradoxical situation in India, related to food production and health related issues. India claims to have become self sufficient in food production but 22% of it's population is below the poverty line. India shares 25% of the agricultural produce of the world but on the International Food Policy Research Institute's (IFPRI) 2018 Global Hunger Index (GHI) India ranks 103rd out of 119 countries and is home to the largest number of malnourished people in the world, about one quarter of the global total. The same report states that in 2015, 21 % of the children under 5 years of age were wasted and 38% were stunted. Not only the adolescents and adults but people in the age group of 5-19 years are overweight and obese due to over-nutrition and over-consumption of calories. This is accounting for higher rates of diabetes and other non-communicable diseases, morbidity and mortality, particularly in urban areas. In rural India, however, poverty induced malnutrition is the major cause of morbidity and mortality.

No doubt that these paradoxes are primarily due to fast growing population of India, (in mid-January, the population of India crossed the figure of 138 crores) but there seems to be a reason for blaming it on the misjudged or backfiring Government policies. The findings of a recent survey by the Organization for Economic Co-operation and Development (OECD) and the Indian Council for Research on International Economic Relations (ICRIER) are that over the last 2 decades, India has implicitly taxed agriculture at the rate exceeding 14%, largely by keeping food prices low for urban consumers (Todhunter, 2019).Due to the lack of integrated programme, the remedial steps taken through our successive five-year economic plans since 1951, failed to conserve the freshwater ecosystems in an effective manner.

The role of wetlands at large and freshwater wetlands in specific in food security as well as health has been stressed by several authors (Frumkin, 2003; Blowers & Martin, 2009; Boelee, 2011 & 2013; Bunch et al., 2011; Mussa, 2011; Pierre & Finlayson, 2011; Ramana et al., 2013; Turyahabwe et al., 2013; Chakraborty, 2016; George and McKay, 2019; Phoebe et al., 2019; Pillay and Manojkumar, 2019) across the globe. In India, more serious efforts are needed to conserve wetlands for food security and wellbeing.

Positive steps towards conservation of Wetlands

In her book on National wetlands Atlas, Anita Bhaduri (2010) has described the National Wetlands Inventory Assessment (NWIA) project of MoEF, Government of India, launched in 2010 to mark the beginning of serious efforts towards conservation of wetlands in India.The National Plan for Conservation of Aquatic Ecosystems

(NCPA) in 2013 by merging National Lake Conservation Plan (NLCP) and National Wetlands Conservation Programme (NWCP) under 12th five-year economic plan. The idea was that a *single programme would help promote better synergy and avoid overlap of the administrative functions*. In the same year, 2013, National Food Security Act, 2013 (NFSA 2013) was passed to convert into legal entitlements for existing food security programmes of the Government of India, the Midday Meal Scheme (1995), Integrated Child Development Services scheme, the Public Distribution System and maternity entitlements.

The NCPA-MoEFCC Guidelines (2019) were released and several strategic measures to conserve inland as well as coastal wetlands were notified in it. A nationwide inventory of wetlands has been carried out at 1:50,000 scale using pre- and post-monsoon season IRS Satellite data. The wetland Atlas showing 19 categories of wetlands covering States and UTs has been prepared. Accordingly, over 2 lakh wetlands covering around 4.63% of the total geographical area of the country have been mapped. The concept of 'Wetlands Health Card' has also been introduced. Information about each wetland including the area of influence, ecology, hydrology, fisheries and other livelihoods it supports, aesthetic and socioeconomic value, and the villages in the vicinity, is being recorded. The ecosystem services of the wetlands would be assessed along with the geomorphology, meteorology, soil and sediment quality, and biodiversity would also be assessed. The concessions and regulations for the residents around the freshwater wetlands would be determined. With due consideration to all this, under the strategy 1.4, an integrated development and conservation plan and its execution as well as administration would be determined (Aggarwal, 2020).

There is thus scope to believe that these conservation efforts will bear fruits in near future and the freshwater wetlands will see the golden era.

References

- Aggarwal M., 2020, State can alter activities prohibited in wetlands as per latest guidelines. Mongabay News and Inspiration from Nature's frontline in India, 14 January 2020.
- Barbar M., 2007, A drop in the ocean for foresight practitioners: What the future may hold for fresh water usage and availability throughout the globe *Journal of Futures Studies* 11: 61–77.
- Bassi N., Dinesh Kumar M., Sharma A., Pardh-Saradhi P., 2014 Status of wetlands in India: A review of extent, threats and management strategies. *Journal of Hydrology: Regional Studies*, 2 (2014) 1-19
- Bhaduri, A., 2010, National Wetlands Atlas- An updated database of wetlands in India by the Ministry of Environment and Forests. 2010, SAC, ISRO
- Boelee E (ed) 2011. Ecosystems for water and food security. Nairobi: United Nations Environment Programme; Colombo: International Water Management Institute. ISBN: 978-92-807-3170-5
- Boelee E, 2013, Managing Water and Agroecosystems for Food Security. CAB International 2013 ISBN-13: 978 1 78064 088 4
- Blowers B. J. and Martin A., 2009, Biodiversity loss, poverty and climate change: Can one solution fit all? *Journal of Integrative Environmental Sciences* 6: 239–245.

Bouton M. M., 2019, The paradox of India's green revolution. The Hindu Business line, 4 June 2019. <https://www.thehindubusinessline.com/opinion/the-paradox-of-indias-green-revolution/article27472671.ece>

Bunch, M. J., K. E. Morrison, M. W. Parkes, and H. D. Venema. 2011. Promoting health and well-being by managing for social-ecological resilience: the potential of integrating ecohealth and water resources management approaches. *Ecology and Society* 16(1): 6. URL: <http://www.ecologyandsociety.org/vol16/iss1/art6/>

Carter M (2013) Useability index for the Swan Canning Riverpark: assessment manual. PlaceScape, Swan River Trust & Edith Cowan University, Perth

Carter M. (2015) Wetlands and Health: How do Urban Wetlands Contribute to Community Wellbeing?. In: Finlayson C., Horwitz P., Weinstein P. (eds) *Wetlands and Human Health*. *Wetlands: Ecology, Conservation and Management*, vol 5. Springer, Dordrecht. https://doi.org/10.1007/978-94-017-9609-5_8

Chakrabarty M., 2016, Climate change and food security in India, Issue Briefs and Special Reports, 2016

Dhavan V., 2017. Water and Agriculture in India: Status, Challenges and Possible Options for Action. Background paper for the South Asia expert panel during the Global Forum for Food and Agriculture (GFFA)

Everard, M., Kangabam, R. and Tiwari, M.K. 2019. Ecosystem service assessment of selected wetlands of Kolkata and the Indian Gangetic Delta: multi-beneficial systems under differentiated management stress. *Wetlands Ecol Manage* 27, 405–426 (2019). <https://doi.org/10.1007/s11273-019-09668-1>

Fisher B Turner RK Morling P. 2009. Defining and classifying ecosystem services for decision making. *Ecological Economics* 68: 643–653.

Frumkin H (2003) Healthy places: exploring the evidence. *Am J Public Health* 93:1451–1456

George N. A. and McKay F. H., 2019, The Public Distribution System and Food Security in India, *Int J Environ Res Public Health*. 2019 Sep; 16(17): 3221. doi: 10.3390/ijerph16173221

Grzybowski, M. and Glińska-Lewczuk, K., 2019, Principal threats to the conservation of freshwater habitats in the continental biogeographical region of Central Europe. *Biodivers Conserv* 28: 4065–4097 (2019). <https://doi.org/10.1007/s10531-019-01865-x>

Joseph E. A., 2016, Rice Cultivation in Major Wetlands of Kerala, *International Journal of Engineering Science and Computing*, August 2016, 6(8): 2136-2137

Chandra, K., Gopi, K.C., Rao, D.V Subramanian K.A. and Valarmathi K. (eds), 2018, Current Status on Freshwater Faunal Diversity of India – An Overview. Pbl. Zoological Survey of India. https://www.researchgate.net/publication/325035932_Current_Status_of_Freshwater_Biodiversity_of_India_An_Over_View

Madhyastha M. N., Rekha P. D. and Shashikumar K. C., 2000, Wetlands- functions, threats and management, *Proc. Lake 2000, Paper 2*.

http://wgbis.ces.iisc.ernet.in/energy/water/proceed/proceedings_text/section6/paper2/section6paper2.htm#:~:text=Other%20threats%20are%20the%20agricultural,living%20in%20and%20around%20them.

Msusa H., 2011, Sustainable Utilization of Wetlands for Food Security: A Case Study of the Simulemba Traditional Authority in the Kasungu District of Malawi. *Journal of Developments in Sustainable Agriculture*, 6: 86-100

National Plant for Conservation of Aquatic ecosystems (NPCA)- MOEFCC Guidelines, 2019, <http://moef.gov.in/wp-content/uploads/2019/09/NPCA-MOEFCC-guidelines-April-2019-Low-resolution.pdf>

Oshimaya S. N., 2021, What are the major threats to wetland ecosystems around the world, *Environment*, 7 January 2021. <https://www.worldatlas.com/articles/what-are-the-major-threats-to-wetland-ecosystems-around-the-world.html>

Phoebe R. Maund, Katherine N. Irvine, Jonathan Reeves, Emily Strong, Ruth Cromie, Martin Dallimer and Zoe G. Davies, 2019, Wetlands for Wellbeing: Piloting a Nature-Based Health Intervention for the Management of Anxiety and Depression. *Int. J. Environ. Res. Public Health* 2019, 16, 4413; doi:10.3390/ijerph16224413

Pierre, H and Finlayson, C. M., 2011, Wetlands as Settings for Human Health: Incorporating Ecosystem Services and Health Impact Assessment into Water Resource Management. *BioScience*, 61 (9): 678–688, <https://doi.org/10.1525/bio.2011.61.9.6>

Pierre Horwitz, C. Max Finlayson, Philip Weinstein, 2012, Healthy wetlands, healthy people A review of wetlands and human health interactions Ramsar Technical Reports, Ramsar Convention Secretariat 2012. ISBN 2-940073-32-5.

Pillay P K and Manoj kumar T K, 2019, Food Security in India: Evolution, Efforts and Problems. *Strategic Analysis*, 42 (6): 595-611 2018

<https://www.wwt.org.uk/our-work/projects/wetlands-human-health-and-wellbeing/>

Piesse M., 2019, Hunger Amid Abundance: The Indian Food Security Enigma, *Futre Directions International*, Australia pg 2-6.

Ramana D. V., Schramm P. J. and Lubner G., 2013, “Climate change & infectious diseases in India: Implications for health care providers”, *Indian Journal of Medical Research*, 138: 847

Rebello L-M., 2010, Wetlands, agriculture and livelihoods. Report of the International Water Management Institute Johannesburg. https://www.ramsar.org/sites/default/files/documents/library/strp_africa2010_7.2.pdf

Rejula K, Singh R, Nain M.S., 2017, Rice Farming for Food Security and Ecological Sustainability: A an Analysis of farmer's Awareness in Kerala, *Indian Journal of Extension Education*, 53 (4):101-106

Roy Choudhury, 2019, Urbanization, Climate Change and Food Security in the East Kolkata Wetlands, Thesis, Drexel University

State of the world's land and water resources for food and agriculture: Managing systems at risk. 2011. Published by: The Food and Agriculture Organization of the United Nations and Earthscan. FAO ISBN: 978-92-5-106614-0 (pbk)

Todhunter c., 2019, The paradox of food security amid abundance in India and what needs to be done. Outlook Poshan, 28 November 2019. <https://poshan.outlookindia.com/story/poshan-news-the-paradox-of-food-scarcity-amid-abundance-in-india-and-what-needs-to-be-done/343202#:~:text=To%20Be%20Done,The%20Paradox%20Of%20Food%20Scarcity%20Amid%20Abundance%20In,What%20Needs%20To%20Be%20Done&text=Large%20sections%20of%20India's%20population,provide%20adequate%20levels%20of%20micronutrients>.

Turyahabwe, N., Kakuru, W., Tweheyo, M. Contribution of wetland resources to household food security in Uganda. *Agric & Food Secur* **2**, 5 (2013). <https://doi.org/10.1186/2048-7010-2-5>

Vikaspedia. <https://vikaspedia.in/energy/environment/known-your-environment/conservation-of-wetlands#:~:text=Efforts%20to%20conserve%20wetlands%20in,an%20integrated%20approach%20on%20conservation>.

Wetlands and agriculture. Department of Environment, Government of Australia, Report 2016, <https://www.environment.gov.au/system/files/resources/84887186-881a-4c83-b434-3d6a5606eafa/files/factsheet-wetlands-agriculture.pdf>

A Review on Impact of climate change on some important wetlands of Maharashtra

Dr. M.R. Ingle

Associate Professor in Botany, Satish Pradhan Dnyanasadhana College, Thane

rajmandakini@gmail.com

Abstract: Wetlands are diverse in their characteristics due to the climatic conditions and the topography of the area. This influences the functional aspects of the wetlands to a great extent. Wetlands provide various ecosystem services to mankind. In Maharashtra state, out of the total geographical area, wetlands occupies 3.30% with 706 km indented coastal line and inland waters. However the growing demands for water and land and the substantial changes in the climate with increasing temperature and rainfall variations have led to water crisis and imposed threats on these wetlands. There are various attempts made and conservation strategies adopted in the state, yet the wetlands are declining at alarming rates. The wetlands of Nandur-Madhmeshwar and Lonar lake have recently been designated wetlands of international importance and included in the Ramsar site, many in the state remain unprotected and may be permanently lost if effective measures are not taken to conserve them. This paper deals with the importance of wetlands and the impact of the climate change on some important wetlands of Maharashtra. The role of the public, various non-governmental organizations and private bodies in addition to the state government is of utmost importance for achieving the sustainable development goals and securing the wetlands for life.

Keywords: *Ecosystem, Maharashtra, Sustainable, Wetlands,*

Introduction

Wetlands are those areas that occur where the water table is at or near the surface of land or where the land is completely covered by water. These are the areas that primarily control the environment and the associated life.

As per the Article 1.1 of the convention on wetlands (Ramsar, 1996) wetlands are defined as areas of marsh, fen, peatland or water, whether natural or artificial, temporary or permanent, 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.

Article 2.1 provides that wetlands :” may incorporate riparian and coastal zones adjacent to the wetlands or bodies of marine water deeper than six metres at low tide lying within the wetlands. This definition brings ponds , lakes, estuaries, reservoirs, creeks, mangroves and many more water bodies under the ambit of wetlands.

Classification of wetlands

On the basis of their hydrological, ecological and geological characteristics (devised by Cowardin *et al.*, 1979), Wetlands can be classified into marine (coastal wetlands), estuarine (that includes deltas, tidal marshes and mangrove areas), lacustrine (lakes), riverine (areas along rivers and streams) and palustarine (marshes, swamps and bogs).

Economic value of wetland:

Wetlands are among the earth’s most diverse and productive environments, with rich biological diversity comparable to rainforests (Ghermandi *et al.*, 2008). They provide increased primary productivity for the survival of infinite number of species .Wetlands not only support large number of birds, animals, fishes, reptiles, amphibians and invertebrates but also act as repository of plant genetic material.

Wetland systems directly or indirectly offer multiple ecosystem goods and services and support millions of people (Finlayson, 2005). The direct benefits include water for irrigation for agriculture and allied sectors, fisheries, non-timber forest products, water transport, water supply for domestic needs and ground water recharge and recreation. The flood plains are valued for their socio- economic value in rural India. In India, the wetlands play a vital role in terms of fish production (Sarkar *et al.*, 2016) . The inland waterbodies contribute to about 61% of fish production in the country and it is also the second largest aquaculture farmed fish producer in the world. Inland wetlands particularly floodplain wetlands are indispensable resources in fisheries sector that provide a natural habitat for various migratory species. However, except for few ecology and phenology studies there has been no systematic studies reported so far on changing pattern of fish diversity and fisheries of flood plain wetlands concerning climate change in India (Sarkar *et al.*, 2016; Sarkar and Borah,2017) .

The indirect benefits of wetlands arise from the various functions it performs in maintaining the overall balance of ecosystems. The major services include carbon sequestration, flood control, ground water recharge, water quality improvement, sediment and nutrient retention and biodiversity maintenance. Swamps, mangroves, peat lands and marshes play an important role in carbon sequestration the mangroves sequester about 1.5 metric tons of carbon per hectare per year. Wetlands act as sinks for contaminants in many agricultural and urban areas they help to lessen the effect of floods by absorbing water and lowering the speed at which the flood water flows

(Bystrom *et al.*, 2000). A large network of lakes and ponds in major cities like Srinagar, Bhopal, Bengaluru, Chennai and Hyderabad were constructed. Wetlands are the biodiversity hotspots, supporting a diverse biota belonging to all taxonomic groups. The freshwater ecosystems of Western Ghats alone have 290 species of fish whereas the Loktak lake is unique for being the only refuge of the endangered Sangai (Manipur brow- antlered deer). Wetlands serve important breeding and feeding areas for domestic as well as migratory bird species. Sarus crane, black necked cranes and many other migratory species visit the wetlands of Bharatpur wildlife sanctuary in Rajasthan and the coastal areas of Saurashtra, Gujarat. Wetlands offer significant value for tourism, provide livelihood security to the local communities, thus adding to the economy of the nation.

Methodology: The review is based on the secondary data, the various project reports published by the Ministry of Environment and Forests. The data on the wetlands of Maharashtra has been reviewed from the report of National Wetland Inventory and Assessment (NWIA), which was carried out with Maharashtra Remote Sensing Applications Centre (MRSAC), Nagpur. Also various ongoing works carried out by the government, the NGOs and the environmentalists on wetlands have been referred.

Important wetlands of Maharashtra

The most important wetlands of Maharashtra in terms of biological and socio economic value are identified by the National Wetland Atlas of Maharashtra, 2010. MSAAPC report (Table 1)

Table 1 : Most important wetlands of Maharashtra (Source: MSAAPC report)	
Region	Wetlands
Vidarbha	Lonar lake -Buldhana district, Navegaon Notified wetland - Gondia district
Marathwada	Nathsagar Notified Wetland - Aurangabad district, Yeldari Reservoir- Parbhani district
Western Maharashtra	Nandur Madhyameshwar Tank- Nashik district, Ujani Reservoir- Solapur district

In Maharashtra out of the six identified wetland sites : Jaikwadi (Aurangabad district)), Ujani (Pune District), Sewri Creek (Mumbai district), Nandur Madhmeshwar (Nashik district) and Lonar (Buldhana district), two of them have been designated as Ramsar sites :Nandur Madhmeshwar and Lonar. For these, conservative measures and their protection will be internationally significant.

Jaikwadi wetland in Aurangabad district is the best man made wetland on river Godavari constructed mainly for irrigation.

Nandur Madhmeshwar wetland site has been formed by shallow backwaters of the dam and is a mosaic of lakes, marshes and riparian forest on the Deccan plateau. It was constructed to overcome shortage of water in the surrounding area. This wetland boasts of threatened plants like Indian sandalwood and migratory birds, but due to the urban developmental changes and water abstraction and eutrophication is itself threatened.

Lonar lake is unique, a crater formed by a meteorite impact onto the basalt bedrock. The lake is highly alkaline and saline and during high temperatures due to increased evaporation there is concentration of minerals. Studies show that the household sewage and waste water effluents are the key factors that dilute its salinity. The physical properties of water being altered, most microbes will not be able to survive

Excellent mangrove vegetations have been found in estuaries and creeks along the coast of Maharashtra, particularly in Thane, Raigadh, Navi Mumbai, Ratnagiri and Sindhudurg. Although Mumbai Metropolitan region wetlands have not been listed, it has a special mention for conservation. The two wetlands in Mumbai suburbs have been identified for Ramsar sites : the Mahul Sewri wetlands and the Thane Creek Flamingo sanctuary and necessary efforts are being taken by environmentalists and various NGOs. The Mahul Sewri mudflats has littoral type of mangroves that provides refuge to threatened species during adverse conditions. And supports more than 20,000 water birds.

Loss of wetlands:

According to the United Nations world water development report 2020, the degradation and loss of wetlands all over the world is quite alarming. India as well is highly due to the anthropogenic activities and the climate change influenced by modernization and industrialization. Between 1970 to 2015 the extent of wetlands has considerably declines, almost 35% (Crump, 2017). In Maharashtra almost 523 wetlands have been lost between 2012 to 2017.

Urbanization and increased population growth has exerted enormous pressure on wetlands, inland waters and flood plain areas for fulfilling the water and food demands (Bassi and Kumar, 2012). Various factors like encroachment, deforestation, land reclamation, habitat fragmentation has contributed to the reduction in the areas of wetlands permanently. The Kanwar Lake in Bihar has shrunk to almost one third of its size. Many coastal and mangrove areas in Uran, Kharghar, Sea woods of Mumbai region have recently been in news for encroachment and illegal activities would change the conserved CRZ region into commercial zone (Times, 6th Dec 2020). Also

the fertilizer residues due to increased fertilization of agricultural soil find its ways into the water bodies resulting in eutrophication and algal blooms. The discharges of sewage and untreated municipal and industrial effluents have polluted the waters of the wetlands causing habitat damage of various plants and animal species.

The impact of climate change :

The effect of climate change on the degradation of wetlands can be attributed to the changes in the hydrological cycle operating in the ecosystem. The variations in the wetland ecosystems are directly dependent upon the temperature, the rise in sea levels, the storms and the quantity and quality of water availability (Poff *et al.*, 2002). The melting glaciers and rise in temperature of the oceans definitely have negative impact on the wetlands located in high altitudes as well as coastal areas like mangroves and coral reefs (UNWWR, 2020). Flooding of the rivers and the coastal storm surges threaten to destroy many wetlands which would result in decreased filtering, buffering carbon sequestration fisheries and aquaculture services that they provide (Blumenfeld *et al.*, 2009).

As per the studies reported there has been a rise in the mean sea level due to climate change. This can be attributed to the thermal expansion of water due to rise in global temperatures, and therefore the rise in sea levels leads to flooding of waters in low-lying coastal areas. Also isolated incidents of torrential rains caused by global warming leads to accumulation of silt along coastal zones that further reduces the depth of shallow wetlands (HT, 12 April, 2019).

As per an estimate (UNESCO report, 2014) India will lose about 84% of coastal wetlands and 13% of saline wetlands due to the climate change and induced sea water level rise of 1 metre. The finding of the report are crucial for India which has been experiencing flood- drought- flood cycle for the past two decades. Maharashtra has a coastal line of 706 km, and will therefore be greatly affected by climate change and is experiencing floods, storms, droughts in the recent decades. The wetlands of coastal regions of Thane, Mumbai, Raigadh, Ratnagiri and Sindhudurg are the most likely to be affected due to climate change, and will show most detrimental effect compared to the inland wetlands (TERI, 2014).

Maharashtra State Action Plan, 2014 (TERI, 2014) on Climate change has identified three districts in Maharashtra that are vulnerable and also reported Mumbai to be one of the most vulnerable region to climate change. Therefore the wetland conservation, micro water shed protection, mangrove and forest protection remain the key issues (HT, 29th Feb. 2020).

According to the analysis report by McKinsey & Company Inc. almost three million people living within one kilometer of the Mumbai city's coastline are under threat from coastal flooding, storm surges and sea level rise. The average rainfall in Mumbai is 250-300cm and is sufficient to maintain the constant ground water table and the level of wetlands. The wetlands in MMR makes up 1.12% of the total land area. The satellite imageries show that there has been considerable decrease in the wetland areas in recent years. The indiscriminate and deliberate destruction of wetlands due to pollution, industrialization, encroachment, deforestation and the bureaucrat-businessmen- political nexus over the past few decades has led to serious consequences such as increased flooding, extinction of species and poor water quality. The catastrophic deluge that engulfed Mumbai on 26th July 2005 is an example although the reasons being many, but the climate change as well as loss of wetlands that act as sponges during floods due to reclamation along Mithi river, encroachment by rapacious builders, old drainage and sewage systems are found to be the other key factors.

Conservative Measures taken :

Following the Paris Agreement, India has its own nationally determined contributions and sustainability development goals. Maharashtra government too has started updating the state action plan based on NDCs and SDG. However action oriented plans for each climate change parameter needs to be implemented and can be achieved by thorough participation of stake holders. Space Application Centre has carried out various pilot projects for development of GIS based wetland information system (Patel *et al.*, 2003) and Lake Information system (Singh *et al.*, 2003). A memorandum of understanding has been signed between the Space Applications Centre, Ahmedabad under Indian Space Research Organization and Indian Council of Agricultural Research-Centre Marine fisheries Research Institute, Kochi. The MoU under the National Initiative on Climate Resilient Agriculture (NICRA) launched by the Centre in February 2011 has been a boost for wetland conservation in Maharashtra

Conclusion: Although there is a great potential of coastal and inland wetlands in Maharashtra, the anthropogenic activities has rendered them in a devastating situation and its now a high time that the state government should take immediate and appropriate actions for sustainable development. This requires the combined efforts of the local, the NGOs and the government authorities. Implementation of proper water conservation and water use strategy will not only minimize the financial burden of the government but also try to keep the hydrological cycle in nature stable and would help to conserve the biodiversity in those wetland areas. Wetland awareness programmes pertaining to various issues and challenges in wetland management to be conducted to educate the professional as well as the locals. Adopting approaches like long-term planning and proper regulatory frame

work with consistent efforts these challenges could easily be converted to opportunities for the coming generations.

The critical issues of water crisis through wetland management by adopting approaches like integrated long-term planning and proper regulatory framework. Through a series of concerted and consistent efforts the current challenges could easily be transformed into opportunities for the next generations.

Bibliography

- Bassi, N. and Kumar, M.D. (2012). Addressing the civic challenges: perspective on institutional change for sustainable urban water management in India. *Environ. Urban. Asia* 3(1), 165- 183.
- Blumenfeld, S., Lu, C., Christopherson, T. and Coates, D. (2009). Water, Wetlands and Forests. A Review of Ecological, Economic and Policy Linkages. Secretariat of the Convention on Biological diversity and Secretariat of the Ramsar Convention on Wetlands, Montreal and Gland.CBD Technical Series No. 47.
- Bystrom, O., Hans Andersson and Ing- MarieGren. (2000). Economic criteria for using wetlands as nitrogen sinks under uncertainty. *Ecological Economics*, 35 (1): 35- 45.
- Cowardin, L. M., Carter, V., Golet, F. C. and LaRoe, E. T. (1979). Classification of Wetlands and Deepwater Habitats of the United States , U. S. Department of the Interior, Fish and Wildlife Service, Washington, D.CC.
- Crump, J.(2017). Smoke on Water: Countering Global Threats from Peatland Loss and Degradation. UN Environment, GRID- Arendal.
- doi. 10.1007/s11273-017-9559-6
- Finlayson, C.M. Spiers, A. G. (Eds), (1999). Global Review of Wetland Resources and Priorities for Wetland Inventory , Supervising Scientist, Canberra, Australia.
- Ghermandi, A., van den Bergh., J. C. J. M., Brander, L. M. and Nunes, P.A. L. D. (2008). The Economic value of Wetland Conservation and Creation: A Meta- Analysis [Working Paper].fondazione Eni Enrico Mattei, Milan, Italy.
- MoEFCC (2020). Ramsar Sites of India – Factsheets. Ministry of Environment, Forest and Climate Change, Government of India
- National Wetland Atlas: Wetlands of International Importance Under Ramsar Convention, (March 2013). Sponsored by Government of India space applications Centre, ISRO, Ahmedabad
- Patel, J. G., Singh, T. S. and Garg, J. K. (2003). Wetland Information System, West Bengal. SAC/RSAM/RESA/FLPG/WIS/01/2003, A Technical Report: Space Applications Centre, Ahmedabad.
- Poff, N.L., Brinson, M.M. and J.W. Day(2002). Aquatic Ecosystem and Global Climate Change, Arlington, Va.: Pew Centre on Global Climate Change.

- Ramachandra, T.V. Rajnikanth, R. and Ranjini, V.G. (2005). Economic valuation of wetlands. *Journal of Environmental Biology*, 26 (2): 439-447.
- Sarkar, U. K. and Borah, B. C. (2018). Flood plain wetland fisheries of India: with special reference to climate change. *Wetlands Ecology and Management*, 26 (1): 1-15.
- Sarkar, U.K., Nag, S.K., Karnatak, G. and Sudheesan, D. (2016). Conserving wetlands- An Effective Climate Change Adaptation in India. Bulletin No. NICRA/CIFRI/2015-16/2, ICAR-Central Inland Fisheries, 9pp. Institute, Barrackpore. ISSN :0970-616X
- Singh, T. S., Patel, J. G. and Garg, J. K. (2003). Loktak Lake Resources Information System (LRIS), SAC/RSAM/RESA/FLPG/WIS/02/2003, A Technical Report: Space Applications Centre, Ahmedabad.
- T E R I (2014). Assessing Climate Change Vulnerability and Adaptation Strategies for Maharashtra: Maharashtra State Adaptation Action Plan on Climate Change (MSAAPC), New Delhi: The Energy and Resources Institute. 302 pp. [Project Report No. 2010W01]
- http://moef.gov.in/wp-content/uploads/2019/09/Ramsaar-Factsheets_2020-Final-8-May-2020.pdf
- <https://unesdoc.unesco.org/search/e350fdb8-64e0-4ff4-876d-f585fe22759a>
- <https://www.hindustantimes.com/mumbai-news/523-wetlands-were-destroyed-in-maharashtra-in-five-years-report/story-vXeoZjltyhMeB4GGMALWTI.html> 523 wetlands
- <https://www.hindustantimes.com/mumbai-news/coastal-wetlands-get-two-big-protectors/story-g2BYqWh6zuHq7LXS9EUjbI.html>
- <https://www.ramsar.org/news/india-names-two-more-wetlands-of-international-importance>
- www.ramsar.org

Sustainable Development and Conservation of Wetlands using precast concrete

Azhar Khan¹, Amaan Mirekar¹, Saquib Bhatkar¹, Dr. Uma Kale²

1. Undergraduates pursuing B.E in Civil Engineering, M.H. Saboo Siddik College of Engineering, Mumbai, India
2. Assistant Professor, PhD Environment, M.H. Saboo Siddik College of Engineering, Mumbai, India

Abstract:

Wetlands are areas of great natural productivity, hydrological utility, and environmental diversity, providing natural flood control, improved water quality, recharge of aquifers, flow stabilization of streams and rivers, and habitat for fish and wildlife resources as well as provides valuable public access for education and recreation activities. Debilitated wetlands didn't simply go from bad to good through quick-and-easy trash pickup and environmental petitions, the stereotypical means of fixing ecological disarray. Precast retaining wall found the best solution for the wetland's rehabilitation. The precast concrete structure can be used to facilitate water control management as well as conservation of the wetland cells. The precast concrete structure, which having the ability to manage precise water levels is key because it allows a wetland manager to promote aquatic plant communities and water depths that maximize benefits to wetland dependent wildlife species. This improvement project provides a much-needed upgrade that allows us to manage the area's drainage so that our region's wildlife species can continue to thrive.

1. Introduction:

The conservation and wise use of wetlands is primarily to provide a habitat for water birds and to keep environmental diversities. Thane creek, located between Mumbai harbor with two shipping hubs that are the Mumbai Port and the Jawaharlal Nehru Port on its south, the Ulhas River on its north is 26 kms long and its narrower upper areas have mudflats, salt pans and diversity-rich mangrove forests. B.N. Bandodkar College of Science Thane and Bombay Natural History Society have found that the creek is home to more than 160 bird species and nine species of mangrove trees, besides fish, crustaceans and insects. The wetland and the adjacent Thane Creek Flamingo Sanctuary are globally significant, serving as a stop for migratory birds using the Central Asian Flyway which stretches across Asia, Europe and the Arctic and Indian Oceans. Despite its status as a protected sanctuary, the creek is threatened by pollution and encroachments. Another study, by B.N. Bandodkar College of Science, Thane, said the creek's biodiversity has declined over the decades because of industrialization and expansion of urban areas on its banks. The study found low dissolved oxygen, high nutrients from runoff and siltation. The high nutrients can lead to excessive growth of phytoplankton that can choke other aquatic life. To deal with low water quality problems Oxidation pond is one of the best solutions to increase dissolved oxygen and remove unwanted gasses from wetland waters for healthy growth of plants and other living organisms thriving in area. To control the water level and invasion of land precast concrete Retaining walls are one of the solutions so that construction at such sensitive place can be done without any ecological disturbance as whole structure is cast in factory.

2. Materials:

The primary constituents of precast concrete are cement, fine and coarse aggregates, water and admixtures. The following discussion covers relevant factors in the selection and use of these fundamental materials.

2.1 Cement:

The quantity of cement has been brought to the laboratory and stored in a dry place. The chemical composition of OPC cement is shown in Table 1, and the physical properties are shown in Table 2.

Table 1. Chemical compositions and main compounds of portland cement

Oxide	% by Weight
CsO	62.13
MgO	2.7
SiO ₂	22.01
SO ₃	2.4
Fe ₂ O ₃	3.3
Al ₂ O ₃	5.26
Loss on ignition	1.45
C ₃ S	32.5
C ₂ S	38.7
C ₃ A	8.3
C ₄ AF	10.4

Table 2. Physical properties of Portland cement

Physical properties	Test result
Specific surface area (Blain) cm ² /g	290
Initial setting (Vicat Method) min.	92
Final setting (Vicat Method) hr.	3:30
Compressive strength (MPa)	
3-days	16.5
7-days	25.7

2.2 Fine Aggregate

Table 3 shows the sieve analysis of fine aggregate used.

Table 3. Sieve analysis of fine aggregate

Sieve size(mm)	Percentage passing
4.75	100
2.36	92.24
1.18	84.89
0.6	70.18
0.3	33.31
0.15	0.71

2.3 Coarse Aggregate:

The natural river with irregular shape gravel used as a coarse aggregate. Maximum size of 12.5 mm for all mixes. The selection of this size is based on the consideration of getting acceptable workability. Table 4 shows the used grading of coarse aggregates.

Table 4. Grading of coarse aggregate

Sieve size(mm)	Percentage passing
12.5	100
10	96.5
4.75	15.1
2.36	0.5

2.4 Sustainable material:

In addition to above basic material for precast concrete for making it sustainable various additional materials such as use of construction and demolition waste in precast member, use of suitable plastic waste for improving certain characteristics of concrete should have made in use.

3. Method:

The polluted water may be treated using the aquatic plants, in wetlands containing floating or submerged aquatic plants, the natural processing of vegetation, soil and microbes which improves the water quality of wetland. The wetland water quality can be improved by the storing of water in open pond for around 24hrs for oxidation. The pond shall contain fountain aerator or Casagrande aerator for introducing the oxygen to the water. It will also attract the people and help for awareness towards the conservation and maintenance of wetlands. The stored water should allow to flow through the constructed filter bed including stone pebbles and sand. The water after passing through filter shall be store in section of pond containing the aquatic plant. Where it will reduce the hardness, COD, BOD, turbidity, etc. of the water. The different kind of aquatic plants like Typha, Phragmites, Alternanthera, Ipomoea, Solanum, Reed bed, etc. can be used. By such arrangements using precast as primary element in construction of oxidation pond and aerator. For the prevention of expansion of urban area into the banks of wetland as well restricting entry of polluted runoff from industries retaining walls are one of the best remedial measure for conservation of wetland. Conducting construction activity in such sensitive area is also objectionable for that precast concrete members for retaining wall shall be made use. They can be placed on a Precast Foundation of varying size that has been laid beforehand. The two elements are then anchored through a concrete pour. If the terrain requires it, piles or micropiles can be driven into the ground before the laying of the Precast Foundation. The Precast Retaining Walls are produced in different types: exposed cement facing, covered in local stone or with horizontal flowerbeds (stone-grass or cement-grass). They can be used for the construction of retaining walls for embankments, toe walls, counterscarp walls, bridge abutments, abutments for artificial tunnels and sound-absorbing barriers.

3.1 Item specifications:

Precast Concrete Retaining Wall with cement facing, covered in stone with horizontal flowerbeds, factory produced certified or controlled series products supplied with a suitable Precast Foundation, made up of vertical or sloping panels in vibrated cement with stiffening ribs on the side facing the soil which go from bottom to top, from which rebars jut out to enable fastening with the Precast Foundation; the visible part can be covered with a natural or artificial stone facing which blends in with the surrounding ecosystem to safeguard the environmental impact. The wall can be fitted with horizontal self-draining flowerbeds so that vegetation may easily grow to allow the wall to blend in better with the surrounding environment. The wall is sized according to the current regulations regarding the verification of sliding, toppling and the maximum load of the foundation-wall-soil structure and according to current regulations regarding works carried out in reinforced concrete and, where necessary, according to current ant seismic regulations

3.2 Precast strip foundation for retaining wall:

The Precast Foundation is a reinforced concrete element made up of a tied rebar beam cage incorporated within a semi-precast concrete element which acts as formwork.

3.3 Assembly of retaining wall and foundation:

During the assembly process, the Precast Foundation is placed on the lean concrete, which has previously been prepared, then the Retaining Wall is mounted on the foundation and the bent rebars jutting out from the base are inserted inside the Foundation element. A final casting of concrete embeds the Wall's rebars inside the Precast Foundation. The work is completed with the removal of all adjustment devices. For the assembly and alignment of the Retaining Wall, adjusting devices are used. These allow an easy, fast and precise installation. During the production phase of the Precast Strip Foundation, two anchor bolts are left within its internal concrete beams,

while the Retaining Wall is equipped with four threaded couplers. The adjusting devices are fixed to the anchor bolts using nuts and to the Retaining Wall using bolts. This system not only allows the Precast Retaining Wall to be aligned with pinpoint precision, but also eliminates any kind of shoring during the assembly. The two adjusting devices will be dimensioned in relation to the weight and other strains to which the Retaining Wall is subject and are used merely for assembling the precast elements.

3.4 Concreting:

When the concrete inside of the Precast Foundation has cured, all the adjusting devices are removed. Thanks to the technology with which it has been designed, the two precast structures manage to form, after the final pour of concrete, a perfect monolithic structure has been made.

3.5 Dimensions:

The Precast Foundation can be produced in different forms and dimensions to satisfy every design and structural need.

4. Result:

The use of steel, in-situ concrete, and Precast was studied in detail to find the sustainable use and economy in the construction and maintenance life of the structure to be constructed in wetland. The steel was unsuitable as the welding of numbers of joint was required and due the corrosion of steel due to climatic condition and the presence of minerals and salts in soil and water. The in-situ concrete was unsuitable due to the site conditions as it was difficult for concreting in site at the wetlands due to marshy area or unavailable space for the storage of cement as the humidity in air and surface of ground are partially-saturated or fully saturated. The use of RMC was also quite difficult due to arrangement of conveyance pipe was large and required large number of man-force, for the assembly and dismantling of the conveyance arrangement. The use of Precast Concrete Structure was the next option for achieving sustainability and economy in construction. As the Precast panels are constructed in factory at proper quality control and proper specification, and the precast panel required only assembly of parts, at site thus the construction time was reduced as much as 30%. The precast concrete was found economical as the factor affecting the In-situ construction was found to be negligible in Precast Concrete. Also the consumption of material is less in precast concrete. Also, the use of Aquatic plant makes the system work sustainably and thus it work with natural processing for the treatment of water and the use of disinfectant was negligible. The use of fountain aerator with the use of LED lights attracts the attention of people in developing the awareness of conservation of wetlands and revivifying of the local dead water bodies. Also, it increases the oxygen content in the water adding freshness to the stagnant water.

5. Discussion:

By providing wetland conservation structures following benefits can be achieved:

5.1 Retaining wall:

Retaining walls are relatively rigid wall used for supporting the soil mass laterally so that the soil can be retained at different level on two side. The retaining wall will be providing the safety against the storm-water coming from the adjacent side thus reducing risk of high pollutant runoff entering in wetland and the prevention of landslide for the safety of structure passing over the wetlands. The retaining wall will help in improving the catchment area of the wetland. The advantages of use of precast leads to

1. 30%-40% savings on completion time.
2. 30% saving on the total cost of construction.
3. The work is done without the need of skilled labor for the binding of reinforcement at site.
4. The panels of retaining wall are assembled with the speed as it is casted at factory.

5. The supply and transportation of formwork material to the site are eliminated.

The disadvantages are

1. The transportation of the casted panel to the site of construction are costly and difficult to handle.
2. The skilled labors are required to assemble the precast panel with high precision.

5.2 Aquatic Plant:

The aquatic plants help in treatment of water due to natural process of the purifying the water. The use of plant reduces the cost of disinfectant. The plant may be floating plant or the submerged plant in the wetland. The aquatic plant also provides prevention against the flood. The aquatic plants can be used as low-cost extraction devices to purify polluted water. In some cases, Plants decompose waste faster than microorganism. These methods can be applied to large areas to complete the decontamination of restricted areas in lengthy periods. But the process is limited to shallow water or the depth to which roots can penetrate. The process can be time consuming. There is a biological limit to the metals and compounds that can be captured.

5.3 Aerator:

The aerator exposes the large surface of water to the atmosphere for imposing oxygen to the stagnate water adding the freshness to the still water. Also, the use of LED light will attract the people attention towards the development of barren and wetland. The awareness regarding the conservation of wetland. It will improve the quality of water which will be utilize by the wildlife and the fishes in the wetlands.

Reference:

1. <https://precast.org/2009/07/precasts-role-in-protecting-the-wetlands-of-washington/>
2. <https://www.forconstructionpros.com/concrete/news/21160322/precast-concrete-bridges-installed-to-improve-wetlands>

A survey on status of wetlands for biodiversity conservation

Aakriti Tamrakar

Department of Forestry, Wildlife & Environmental Sciences,
Guru Ghasidas Vishwavidyalaya, Bilaspur, Chhattisgarh, India.

Abstract

A *wetland* is distinct ecosystem where the land is covered by water. It plays a vital role for biodiversity by maintaining the ecological balance. In this paper the present status of wetlands of Ratanpur has been assessed through primary field surveys, questionnaires and secondary records of Nagar Palika. The historical Ratanpur town, located about 25 kilometres from Bilaspur on NH 200, was known for Mahamaya temple (considered as one of the shaktipeeth) and other temples. This town is also known as 'Land of Ponds' having 159 registered ponds, including 22 private ponds. These ponds receiving runoff water from the hills and used traditionally for drinking, domestic use, irrigation, socio-cultural and religious needs etc. These ponds also harbours rich biodiversity of macrophytes and supports more than 44 species of fishes, 52 species of birds including migratory birds, and various amphibians, turtles, insects etc. In recent years these wetlands are under increasing anthropogenic pressure with human settlements, encroachments growing around them and the pollution caused by religious, cultural and recreational activities. Of the recorded ponds, 102 ponds found in good condition whose water quality are generally good for bathing. Around 50 ponds were in poor condition, which are covered with water hyacinth creates dense mats of biomass on water surface, reducing light to submerged vegetation, cause oxygen depletions etc. and also causes 92% increase in water loss due to evapo-transpiration. There were 7 ponds which get extinct. Thus there is urgent need of awareness, proper management, restoration and treatment of water bodies to conserve these wetlands.

Key words: Wetlands, Conservation, Ratanpur.

OBJECTIVE: Survey in the land of ponds, to find the Status, Strategies for Restoration, Conservation and Management.

INTRODUCTION: Wetlands are the most productive and biologically diverse but very fragile ecosystems. Wetlands play a vital role in the maintaining the ecological balance. Biodiversity is a basic property of nature. It is the variety and variability among the living organisms., I have surveyed the present status of wetlands present in Ratanpur town, The Ratanpur is a Nagar Palika Parishad under Bilaspur district located about 25 kilometres from Bilaspur(C.G.) on National Highway 200 & it is situated at an elevation of 307 m from the sea level. It is located within 22o 17' to 22o 3' N latitude and 82o 10' to 82o 17'E longitude covering an area of 44.24 sq km. This town is also known as 'Land of Ponds' having 159 registered ponds. A pond is a body of standing water, either natural or man-made, that is usually smaller than a lake.

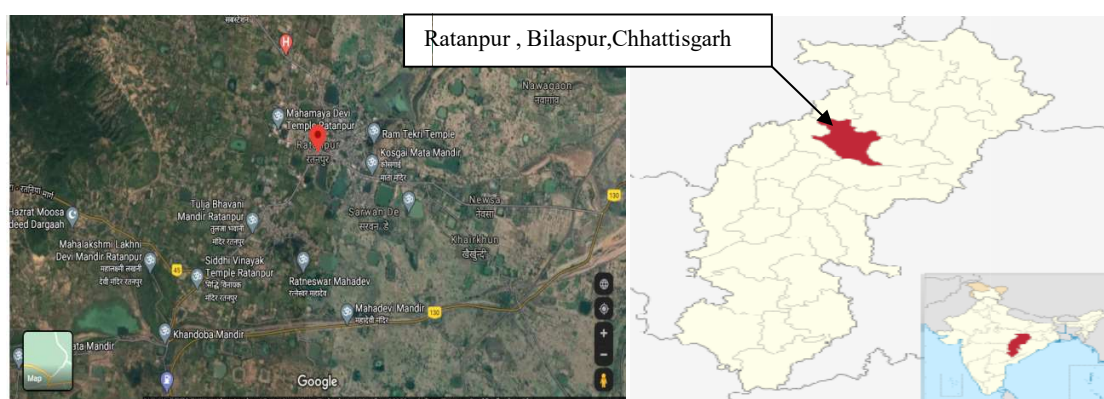


Fig.1-Location Map of Guru Ghasidas University campus, Bilaspur, Chhattisgarh, India (Source: Google Earth)

METHOD: For collection of primary data I have visited many wetland sites of Ratanpur, where I have taken some pictures of ponds & also asked some questions to villagers by using own designed questionnaire format & after the field survey I'm dealing with large amount of data which requires a systematic approach for data entry. Before data entry, the collected data should be verified. So I went to the Nagar Palika of Ratanpur for verification & for secondary data. I have observed & identify many types of birds during wetland survey and made checklist, Study area visited 5 times in a month, the observation were made between 06.00 hrs to 12.00 hrs morning and 04.00 hrs to 06.00 hrs evening and birds were identified.

RESULT:

Table no. 1 , After data analysis, results are following:

Total no. of ponds	159
No. of private ponds	22
No. of ponds in good condition	102
No. of ponds in poor condition	50
No. of ponds extinct	7

Table no.2, Bird checklist near wetlands of Ratanpur

S.No.	Common Name	<u>Scientific Name</u>	Conservation status
1.	Cattle Egret	<u>Bubulcus ibis</u>	Least Concern
2.	Purple Heron	<u>Ardea purpurea</u>	Least Concern
3.	Indian Pond Heron	<u>Ardeola grayii</u>	Least Concern
4.	Asian Openbill	<u>Anastomus oscitans</u>	Least Concern
5.	Black Kite	<u>Milvus migrans</u>	Least Concern
6.	White breasted Waterhen	<u>Amaurornis phoenicurus</u>	Least Concern
7.	Bronze-winged Jacana	<u>Metopidius indicus</u>	Least Concern
8.	Little Cormorant	<u>Phalacrocorax niger</u>	Least Concern
9.	Intermediate Egret	<u>Mesophoyx intermedia</u>	Least Concern
10.	Laughing Dove	<u>Streptopelia senegalensis</u>	Least Concern
11.	Spotted Dove	<u>Streptopelia chinensis</u>	Least Concern
12.	Rock Pigeon	<u>Columba livia</u>	Least Concern
13.	Greater Coucal	<u>Centropus sinensis</u>	Least Concern
14.	Indian Roller	<u>Coracias benghalensis</u>	Least Concern
15.	Little Swift	<u>Apus affinis</u>	Least Concern
16.	Pied Kingfisher	<u>Ceryle rudis</u>	Least Concern
17.	Common Kingfisher	<u>Alcedo atthis</u>	Least Concern
18.	Black Drongo	<u>Dicrurus macrocercus</u>	Least Concern
19.	Coppersmith Barbet	<u>Megalaima haemacephala</u>	Least Concern
20.	Common Myna	<u>Acridotheres tristis</u>	Least Concern
21.	Purple Sunbird	<u>Nectarinia asiatica</u>	Least Concern
22.	Oriental Magpie Robin	<u>Copsychus saularis</u>	Least Concern
23.	Red-vented Bulbul	<u>Pycnonotus cafer</u>	Least Concern
24.	House Crow	<u>Corvus splendens</u>	Least Concern
25.	Scaly-breasted Munia	<u>Lonchura punctulata</u>	Least Concern
26.	House Sparrow	<u>Passer domesticus</u>	Least Concern
27.	tricoloured munia	<u>Lonchura malacca</u>	Least Concern
28.	Large-billed Crow	<u>Corvus macrorhynchos</u>	Least Concern



Fig: Female of Purple Sunbird



Fig: Pied Kingfisher



Fig: Oriental magpie-robin



Fig: Indian cormorant



Fig: laughing dove



Fig: Cattle Egret



Fig: Common Mynah

Fig: Greater Coucal



Fig: House Sparrow(Male & Female)

Fig: Red vented bulbul



Fig: Indian Roller

Fig: Scaly breasted munia

ANALYSIS:

- Every water bodies are facing pollution and due to this birds and other animals are also having threat.
- Many of these wetland covered with **Jalkumbhi (water hyacinth *{Eichhornia crassipes}*)**, creates dense mats of biomass on water surface, reducing light to submerged vegetation, cause oxygen depletions etc. It causes 92% increase in water loss due to evapo-transpiration.
- Some ponds are under threat of encroachment, Lack of plantation in ponds boundary.
- The findings of the present study provide useful information about the assessment of wetland ecosystem using wetland birds. Unfortunately the human activities are the main threat, such as cutting of roosting and nesting trees, destroying the nest and eggs, catching young animals, illegal hunting as game bird and industrialization in Ratanpur area which harbors various avian fauna along with their suitable habitat or ecological conditions.



Figure showing status of some ponds of Ratanpur



Fig: Polluted wetlands of Ratanpur



Fig: Status of Bikma Pond at Ratanpur

SUGGESTIONS

Need of proper management, restoration, conservation, ponds boundary plantation & awareness, treatment plant for cleaning otherwise ponds will extinct soon.

REFERENCE:

- Records of Nagar palika & Patwari office Ratanpur.
- All bird and wet land photographs are clicked by my camera (D5600).
- Field based recordings.
- Grimmett, R., Inskipp, C. and Inskipp, T., 2011. Birds of the Indian Subcontinent. Oxford University Press, Delhi.
- [https://www.researchgate.net/publication/318288832_BIODIVERSITY_OF_MIGRATORY_BIRDS_IN_KHUTAGHAT_RATANPUR_DIST_BILASPUR CG](https://www.researchgate.net/publication/318288832_BIODIVERSITY_OF_MIGRATORY_BIRDS_IN_KHUTAGHAT_RATANPUR_DIST_BILASPUR	CG)
- <https://shodhganga.inflibnet.ac.in/bitstream/10603/253697/11/11%20summary.pdf>
- <http://ecochronicle.org/wp-content/uploads/2019/05/ec-140107.pdf>
- <https://www.ijsr.in/upload/31270365943.pdf>
- <https://www.tandfonline.com/doi/abs/10.1080/09291016.2018.1484807?scroll=top&needAccess=true&journalCode=nbr20>

BIOREMEDIATION FOR WETLANDS

Authors-Rahul B. Gawli, Mayur S. Hosmani, Saurav M. Bhosle, Abhisar A. Bankar, Dr. Uma Kale

Dept. of Civil, M.H. SabooSiddik College of Engineering,

Byculla, Mumbai, Maharashtra, India.

Phone No-9869653608, 9869849104. Email id- rahul.2117018.ce@mhssce.ac.in, mayur.2117020.ce@mhssce.ac.in

Abstract

As the world is heading towards rapid urbanization and technological advancements, more undesirable and unwanted activities by human is raising major environmental issues like global warming, imbalance in soil ecological processes leading to lower agricultural yield, climate change, etc. Predominantly, among all, xenobiotic recalcitrant compounds (i.e. man made chemical with higher concentration) are being disposed in the environment causing significant hazard owing to its high stability and complexity. However, there are several methods for disposing such materials but the most efficient and significant disposal strategy is said to be bioremediation. One of the most environmental friendly treatment options of such pollutants is bioremediation. As natural bioremediation is quite slow, engineered bioremediation techniques like bio-stimulation and bio-augmentation could be used in treatment wetlands (TWs) for doing the hastening cleaning process. In this chapter, the enhanced bioremediation techniques and the role of plants in the treatment wetlands are discussed. The empirical equations used to evaluate the wetland performance are described next. At the end, case studies of batch experiments and pot-scale treatment wetlands are included for practical understanding of the engineered bioremediation process using treatment wetlands.

Keywords:- recalcitrant xenobiotic compound, bioremediation, bioaugmentation, bio-stimulation, sustainable environmental protection, bioremediation for wetlands.

INTRODUCTION

Bioremediation is a process used to treat contaminated media, including water, soil and subsurface material, by altering environmental conditions to stimulate growth of microorganisms and degrade the target pollutants[6].

A wetland is a distinct [ecosystem](#) that is [flooded](#) by [water](#), either permanently or seasonally, where oxygen-free processes prevail. The primary factor that distinguishes wetlands from other land forms or water bodies is the characteristic [vegetation](#) of [aquatic plants](#), adapted to the unique [hydric soil](#). Wetlands play a number of functions, including water purification, water storage, processing of carbon and other nutrients, stabilization of shorelines, and support of plants and animals. Wetlands are also considered the most [biologically diverse](#) of all ecosystems. [Constructed wetlands](#) are used to treat municipal and industrial [wastewater](#) as well as [stormwater](#) runoff. They may also play a role in [water-sensitive urban design](#)[7].

A constructed wetland (CW) is an artificial [wetland](#) to treat municipal or industrial [wastewater](#), [greywater](#) or [stormwater](#) runoff. It may also be designed for land reclamation after [mining](#), or as a [mitigation](#) step for natural areas lost to [land development](#).

Constructed wetlands are engineered systems that use natural functions [vegetation](#), [soil](#), and organisms to treat wastewater. Depending on the type of wastewater the design of the constructed wetland has to be adjusted accordingly. Constructed wetlands have been used to treat both centralized and on-site wastewater. Primary treatment is recommended when there is a large amount of suspended solids or soluble organic matter (measured as [BOD](#) and [COD](#)).

In constructed wetlands engineered bioremediation techniques like bio-stimulation and bio-augmentation could be used in treatment[8].

Bio-stimulation

Bio-stimulation involves the modification of the environment to stimulate existing bacteria capable of bioremediation. This can be done by addition of various forms of limiting nutrients and electron acceptors, such as phosphorus, nitrogen, oxygen, or carbon (e.g. in the form of molasses), which are otherwise available in quantities low enough to constrain microbial activity[9]. It was described that the addition of nutrients, oxygen or other electron donors and acceptors to the coordinated site in order to increase the population or activity of naturally occurring microorganisms available for bioremediation. Bio-stimulation is a type of natural remediation that can improve pollutant degradation by optimizing conditions such as aeration, addition of nutrients, pH and temperature control. The primary advantage of bio-stimulation is that bioremediation will be undertaken by already present native microorganisms that are well-suited to the subsurface environment, and are well distributed spatially within the subsurface. The primary challenge is that the delivery of additives in a manner that allows the additives to be readily available to subsurface microorganisms is

based on the local geology of the subsurface. Tight, impermeable subsurface lithology (tight clays or other fine-grained material) make it difficult to spread additives throughout the affected area. Fractures in the subsurface create preferential pathways in the subsurface which additives preferentially follow, preventing even distribution of additives. Addition of nutrients might also promote the growth of heterotrophic microorganisms which are not innate degraders of Total Petroleum Hydrocarbon thereby creating a competition between the resident micro flora[10].

Bio-augmentation

Bioaugmentation, or the addition of oil-degrading microorganisms to supplement the

indigenous populations, has been proposed as an alternate strategy for the bioremediation of oil contaminated environments. Other conditions under which bioaugmentation may be considered are when the indigenous hydrocarbon-degrading population is low, the speed of decontamination is the primary factor, and when seeding may reduce the lag period to start the bioremediation process. For this approach to be successful in the field, the seed microorganisms must be able to degrade most petroleum components, maintain genetic stability and viability during storage, survive in foreign and hostile environments, effectively compete with indigenous microorganisms, and move through the pores of the sediment to the contaminants. Successful bioaugmentation treatments depend on the use of inocula consisting of microbial strains or microbial consortia that have been well adapted to the site to be decontaminated. Bioaugmentation involves the introduction of microorganisms isolated from the contaminated site, from a historical site or carefully selected and genetically modified to support the remediation of petroleum hydrocarbon contaminated sites based on the assumption and/or confirmation that indigenous organisms within the

impacted site cannot biodegrade petroleum hydrocarbon.

The role of plants in the treatment of effluents by constructed wetland (CW) systems is under

debate. Here, we review ways in which plants can affect CW processes and suggest two novel functions for plants in CWs. The first is salt phytoremediation by halophytes. We have strong evidence that halophytic plants can reduce wastewater salinity by accumulating salts in their tissues. Our studies have shown that *Bassia indica*, a halophytic annual, is capable of salt phytoremediation, accumulating sodium to up to 10% of its dry weight. The second novel use of plants in CWs is as phytoindicators of water quality. We demonstrate that accumulation of H_2O_2 , a marker for plant stress, is reduced in the successive treatment stages, where water quality is improved. It is recommended that monitoring and management of CWs consider the potential of plants as phytoremediators and phytoindicators[10,11].

MATERIALS

Heavy metals including cadmium, chromium, lead and uranium are elements so they cannot be biodegraded. However, bioremediation processes can potentially be used to reduce the mobility of these materials in the subsurface, reducing the potential for human and environmental exposure. The mobility of certain metals including chromium (Cr) and uranium (U) varies depending on the oxidation state of the material. Microorganisms can be used to reduce the toxicity and mobility of chromium by reducing hexavalent chromium,

Cr(VI) to trivalent Cr (III). Uranium can be reduced from the more mobile U(VI) oxidation state to the less mobile U(IV) oxidation state. Microorganisms are used in this process because the reduction rate of these metals is often slow unless catalyzed by microbial interactions. Research is also underway to develop methods to remove metals from water by enhancing the sorption of the metal to cell walls. This approach has been evaluated for treatment of cadmium, chromium, and lead. Phytoextraction processes concentrate contaminants in the biomass for subsequent removal[12].

METHODOLOGY

There are two main classifications of bioremediation. This refers to where remediation is carried out, not the actual bioremediation technique classes.

Bioremediation is done either:

In situ, where all bioremediation work is done right at the contamination site. This can be polluted soil that's treated without unnecessary and expensive removal, or it can be contaminated groundwater that's remediated at its point of origin. In situ is the preferred bioremediation method, as it requires far less physical work and eliminates spreading contaminants through trucking or pumping away to other treatment locations. Bioventing, biosparging and bioaugmentation are the main technique classes[13].

Ex situ means removing contaminated material to a remote treatment location. This classification is less desirable. It involves the big job of excavating polluted soil and trucking it offsite. In the case of contaminated water, ex situ is rare, except for pumping groundwater to the surface and biologically treating it in an enclosed reservoir. Ex situ bioremediation poses a hazard to spreading contamination or risking an accidental spill during transport. Once at an ex situ treatment site,

three technique classes can be applied. One is landfarming, where soil is spread and biologically decontaminated. Another is composting, which is an age-old process. The third class involves biopiles: a hybrid of stacking material in silos, then composting as a biological treatment.

Bioremediation technique classes are the prescribed physical activities or strategies used in microbial remedies. The overall process starts with isolating contaminated site conditions and characterizing what resident microbes exist. Scientists watch how these microbes already interact with the pollutants, then conduct lab testing to map out colonization requirements. Catabolic activity is studied in the lab, from which a field plan is developed. Once that's implemented, the bioremediation process is monitored, and adjustments are made as necessary [13].

OPERATION

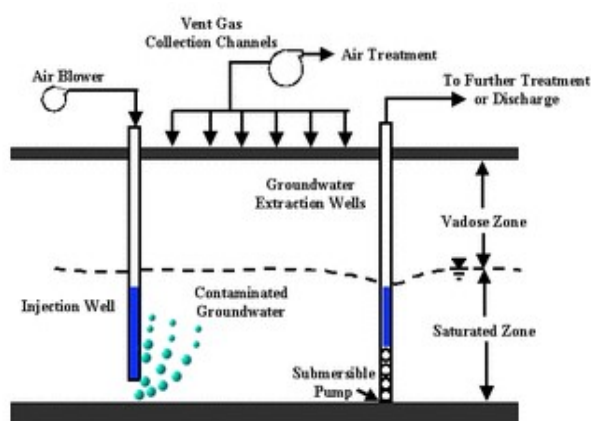
- In situ
- ❖ Air-Sparging

-Air is injected (horizontally and vertically) in channels through the contaminated soil, creating an 'underground stripper' that volatilises contaminants for their removal.

-The process applies to contaminated saturated areas (below the water table) and is commonly used to volatilise NAPLs.

-The injected air helps to flush (bubble) the contaminants up into the unsaturated zone to be removed by SVE.

-High air flow rates are used to maintain increased contact between ground water and soil - increasing quantity treated. The process is enhanced by adding water, nutrients & heat (hot air injection wells).



It is typically medium-long term (few years)[13].

Fig-1

- ❖ Bio-Venting

A Typical Bioventing system

- It is a **natural biological process** in which **aerobically degradable compounds** bio-degrade by **providing oxygen** to existing **soil microorganisms**.
- Air is **slowly pumped** into the contaminated area (in the unsaturated zone) through **(vertical) injection wells**. The number, location, and depth of the wells depend on many geological factors and engineering considerations. It is a **medium-long-term** technology (few months-several years).
- Enhanced** by adding **heat, water, nutrients** and **oxygen** to increase the growth rate of MOs.
- An **air blower** may be used to push or pull air into the soil through the injection wells.
- Nutrients (e.g. **Nitrogen and phosphorous**) may be pumped into the soil through the injection wells.

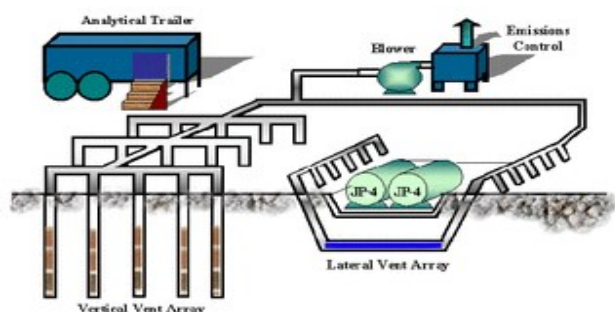


Fig-2

Bio-venting requires:

- Sufficient concentrations of native (pre-existing) MOs.
- Air to be passed through the soil at the apt rate: Quickly enough to maintain aerobic conditions (for microbial activity) BUT slowly enough to minimise VOCs rising to the surface.
- Soil pH ~ 6-8 and warm temperatures[13].

❖ Phytoremediation

Phytoremediation is a process that uses **plants** to **remove, transfer, stabilize, and destroy contaminants in soil** and sediment.

The **type of plants** used govern the **quantity** of water (and hence pollutants) **drawn in**, the **depth of treatment** and the specific contaminant that will be most effectively treated (most commonly **poplar trees** are used - fast growing

with **deep roots** that draw up **lots of moisture**)[13].

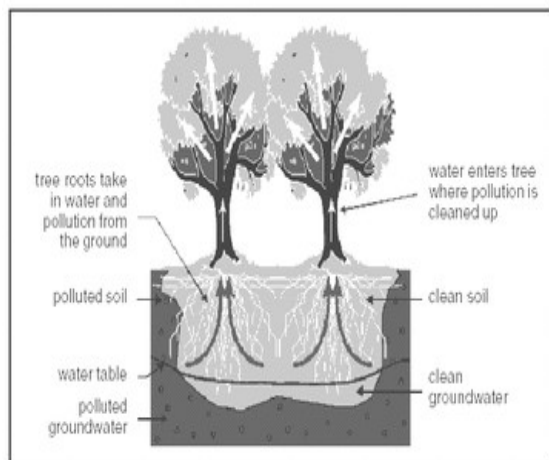


Fig-3

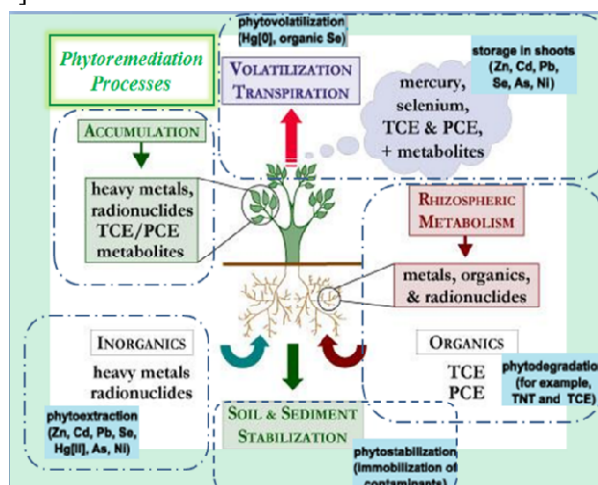


Fig-4

- **Ex situ**

Ex situ techniques include: slurry & solid phase bioremediation:

Solid-phase soil treatment processes include landfarming, soil biopiles, and composting.

Slurry-phase soil treatment processes include the slurry phase bio-reactor[13].

- ❖ **Slurry Phase:**

-Contaminated soil is combined with water and other additives in a large bio-reactor and mixed to keep the indigenous (native) micro-organisms in contact with the contaminants.

-Nutrients & oxygen are added & the conditions in the bio-reactor are controlled (to ensure optimum environment for the MOs to degrade the contaminants.

-Upon completion of the treatment, the water is removed from the solids - wastewater is disposed/further treated if still contaminated.

-Slurry-phase is a relatively rapid process (compared to other biological treatment processes) particularly for contaminated clays[13].

➤ **Slurry Phase Bio-reactor**

- The excavated soil is physically pre-treated to separate stones and rubble. In some cases, it is also pre-washed to concentrate the contaminants into a smaller volume of soil.*
- An aqueous slurry is created by combining the contaminated soil, sediment, or sludge with water and nutrients - amount depends altering the concentration for an apt rate of bio-degradation to occur. (Typically, the slurry contains from 10 to 30% solids by weight).*
- This is then placed into a bio-reactor as shown above.*
- The slurry is mixed to keep solids suspended and microorganisms in contact with the soil contaminants.*
- Upon completion of the process, the slurry is dewatered and the treated soil can be replaced to it's position. Only the contaminated fines & collected wastewater require further treatment[13].*

❖ **Solid Phase:**

- Treats soils in above-ground treatment area
- Equipped with collection systems to prevent any contaminant from escaping the treatment.
- Moisture, heat, nutrients, or oxygen are controlled to enhance biodegradation rates
- Solid-phase systems are relatively simple to operate and maintain BUT require a large amount of space and require a longer time of treatment than or slurry-phase processes[13].

➤ **LandFarming**

Soil conditions are controlled to optimise the rate of contaminant degradation, e.g.:

- Moisture content (usually by irrigation or spraying).
- Aeration (by tilling the soil with a predetermined frequency, the soil is mixed and aerated).
- pH (buffered near neutral pH by adding crushed limestone or agricultural lime).

-Other amendments (e.g., Soil bulking agents, nutrients, etc.).

The waste, soil, climate, and biological activity interact dynamically as a system to degrade, transform, and immobilise waste constitutes.

A Land Treatment site must be managed & monitored properly to prevent both on-site and off-site problems with ground

water, surface water, air, or food chain contamination.

Typically a medium- to long-term technology[13].

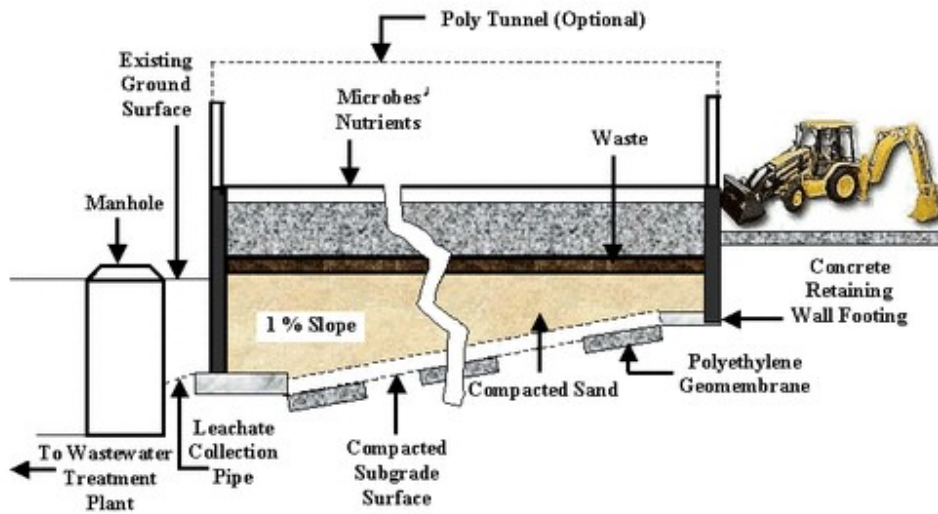


Fig-5

➤ Bio-piles

Excavated soils are mixed with soil amendments and placed in aboveground enclosures. This process also includes leachate collection systems & is used to reduce concentrations of petroleum constituents in excavated soils through the use of biodegradation. It is an aerated static pile composting process in which compost is formed into piles and aerated with blowers or vacuum pumps.

-Moisture, heat, nutrients, oxygen, and pH can be controlled to enhance biodegradation.

-The treatment area will generally be covered or contained with an impermeable liner to minimize the risk of contaminants leaching into uncontaminated soil.

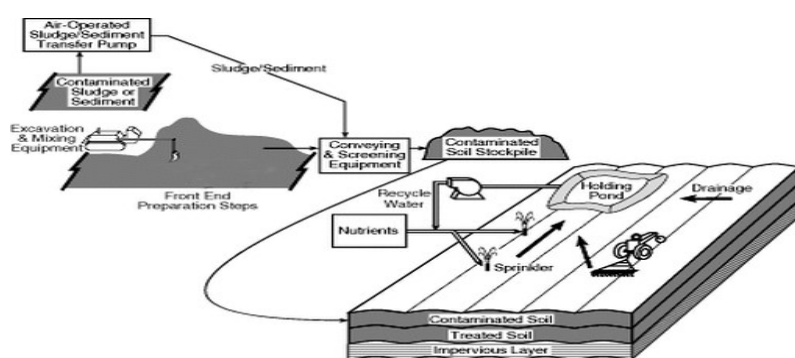
-The drainage itself may be treated in a bioreactor before recycling.

-The air distribution system is typically buried under the soil & passes air through the soil either by vacuum or by positive pressure.

-Soil piles may be covered with plastic to control runoff, evaporation, and volatilisation and to promote solar heating.

-If VOCs are in the soil - these will volatilise into the air stream, thus air treatment would be required.

-Biopile is a short-term technology (few weeks - several months)[13].



4-11 94P-5121 8/22/94

Results & Discussion



Fig-6

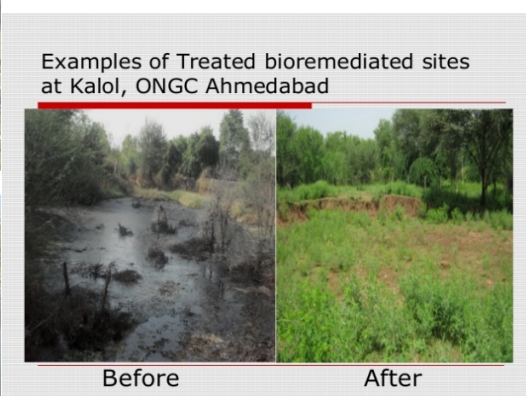


Fig-7

As we can see the effect of implementing bioremediation on wetland from above figures as this technique can be is very convenient to apply and there are many different methods which we can use and this process is not very costly and by following this process it will be very beneficial for our surrounding & for future also it will be good for us.

References

- [1]Akratos CS, Tsihrintzis VA (2007) Effect of temperature, HRT, vegetation and porous media on removal efficiency of pilot-scale horizontal subsurface flow constructed wetlands.
- [2]Kadlec RH, Wallace S (2009) Treatment wetlands, 2nd edn. CRC Press, Boca Raton
- [3]https://link.springer.com/chapter/10.1007/978-81-322-3715-0_24#:~:text=The%20bioremediation%20potential%20in%20the,substrate%20in%20co%2Dmetabolic%20pathways.
- [4]Alvarez PJJ, Illman WA (2006) Bioremediation and natural attenuation, process fundamentals and mathematical models. Wiley-Interscience
- [5]<https://medcraveonline.com/JMEN/bioaugmentation-and-biostimulation-a-potential-strategy-for-environmental-remediation.html>
- [6]<https://en.wikipedia.org/wiki/Bioremediation>
- [7]<https://en.wikipedia.org/wiki/Wetland>
- [8]https://en.wikipedia.org/wiki/Constructed_wetland
- [9]<https://en.wikipedia.org/wiki/Biostimulation>
- [10]https://www.researchgate.net/publication/277216237_Bioremediation_Biostimulation_and_Bioaugmentation_A_Review
- [11]<https://en.wikipedia.org/wiki/Bioaugmentation>
- [12][https://en.m.wikipedia.org/wiki/Bioremediation#:~:text=Common%20electron%20acceptors%20in%20bioremediation,oxidized%20metals%2C%20and%20radionuclides\).](https://en.m.wikipedia.org/wiki/Bioremediation#:~:text=Common%20electron%20acceptors%20in%20bioremediation,oxidized%20metals%2C%20and%20radionuclides).)
- [13]<http://learnbioremediation.weebly.com/in-situ--ex-situ-bioremediation-treatments.html>

Wetland ecosystem and management of freshwater resources

Sandhya S Bind¹ and Jyothi V Mallia, Ph.D²

¹ SY BSc student & ² Assistant professor,

Department of zoology, S.I.C.E.S. Degree College, Ambarnath (W) - 421505

jyothivmallia@gmail.com, sandhyabind2001@gmail.com

ABSTRACT

As described in Ramsar Convention, Wetlands are areas where water is the primary factor controlling the environment and the associated plant and animal life. Wetlands are dynamic and productive ecosystems. They support diverse and unique habitats and are distributed across various topographic and climatic regimes. In India, wetlands provide multiple services to human society, including irrigation, freshwater fisheries, domestic water supply and water for recreation. They are also playing main role in groundwater recharge, flood control, carbon sequestration and pollution abatement. Due to increase in population we are going to face a major challenge in freshwater management for increasing agricultural, industrial and other requirements. There is a need for restoration and formulation of conservation strategies for sustainable management of wetlands. Present paper throw light on suitable strategies for the restoration of lakes and also discusses an overview on the status of wetlands and prevailing legal measures to protect them.

KEYWORDS:-Dynamic ecosystem, wetland, climatic regimes. Freshwater ecosystem, management strategies.

INTRODUCTION:

Wetlands are 'lands transitional between terrestrial and aquatic eco-systems where the water table is usually at or near the surface or the land is covered by shallow water.(Mitsch&Gosselink 1986). They are often likened to the kidneys of the Earth because various nutrients and pollutants are removed from the storm water, agricultural runoff .Wetlands are areas where water is the primary factor controlling the environment and the associated plant and animal life. They occur where the water table is at or near the surface of the land, or where the land is covered by water. Under the Article 1.1 of Ramsar Convention areas of marsh, fen, peatland 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 metres. Article 2.1 states that wetlands may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands” Along with types of wetlands Ramsar convention also specifies importance of Conservation of wetlands as they are site of high biodiversity. As health of wetlands signifies the important part of the development of the country in the present paper, we are looking into the status of freshwater management in our country

Methodology:

This paper is based on the review of literature on Ramsar Convention and special preference to Indian wetlands as an example, Thane creek and management of freshwater resources.

Discussion:

Wetlands in India occupy 58.2 million hectares, including areas under wet paddy cultivation (DeRoy, R. & Hussain, 1993). Majority of the inland wetlands are directly or indirectly dependent on the major rivers like, Ganga, Brahmaputra, Narmada, Godavari, Krishna, Kaveri, and Tapi. They occur in the hot arid regions of Gujarat and Rajasthan, the deltaic regions of the east and west coasts, highlands of central India, wet humid zones of south peninsular India and the Andaman and Nicobar & Lakshadweep islands. (Deepa & Ramachandra 1999).

Indian wetlands are grouped as:

- **Himalayan wetlands**

Ladakh and Zaskar : Pangong Tso, Tso Morari, Chantau, Noorichan, Chushul and Hanlay marshes.

Kashmir Valley : Dale, Anchar, Wular, Haig am, Malgam, Haukersar and Kranchu lakes.

Central Himalayas: Nainital, Bhimtal and Naukuchital.

Eastern Himalayas : Numerous wetlands in Sikkim, Assam, Arunachal Pradesh, Meghalaya, Nagaland and Manipur, Beels in the Brahmaputra and Barak valley.

- **Indo-Gangetic wetlands**

The Indo-Gangetic flood plain is the largest wetland system in India, extending from the river Indus in the west to Brahmaputra in the east. This includes the wetlands of the Himalayan terai and the Indo-Gangetic plains.

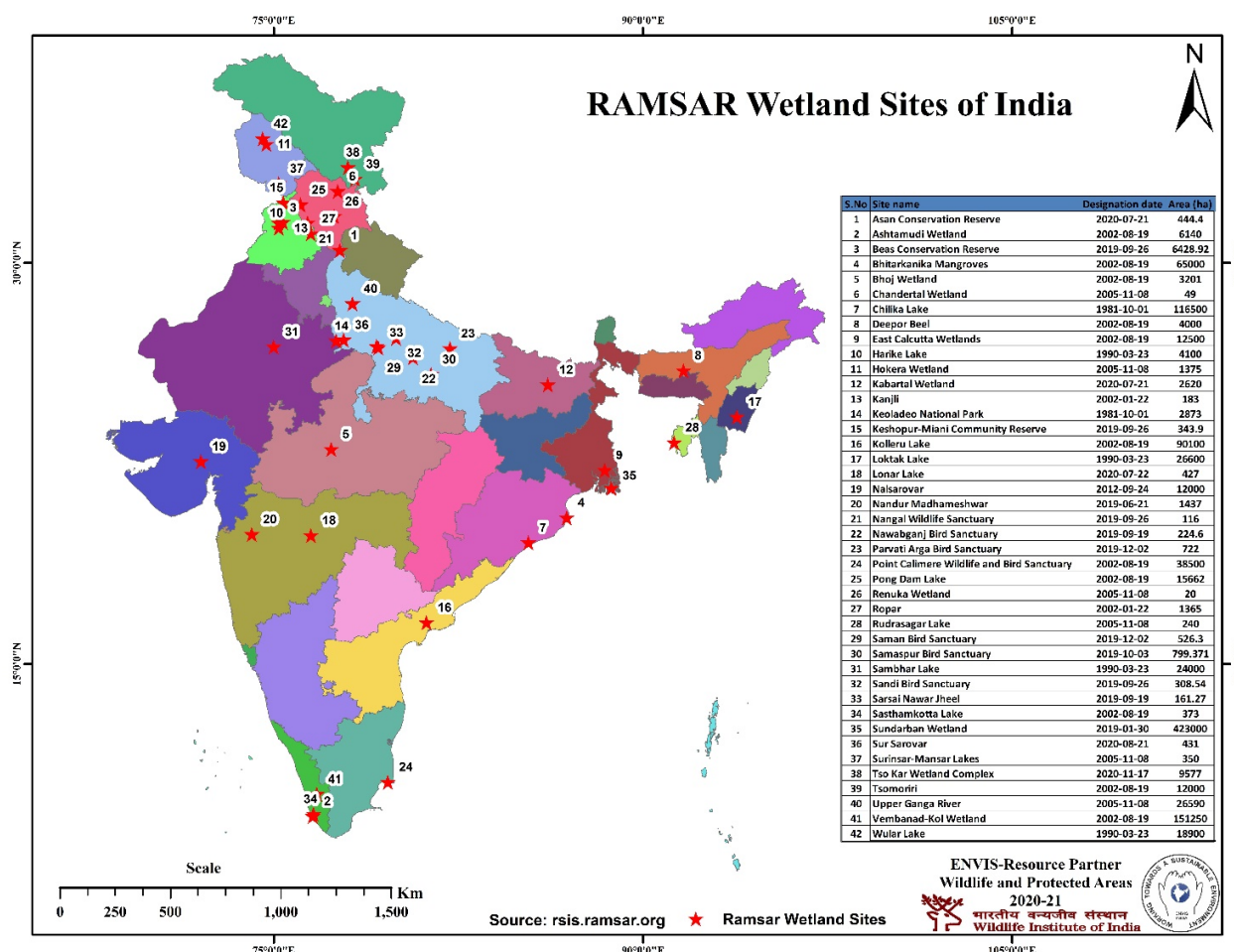
- **Coastal wetlands**

The vast intertidal areas, mangroves and lagoons along the 7500 kilometre long coastline in West Bengal, Orissa, Andhra Pradesh, Tamil Nadu, Kerala, Karnataka, Goa, Maharashtra and Gujarat. Mangrove forests of the Sunder

bans of West Bengal and the Andaman and Nicobar Islands. Offshore coral reefs of the Gulf of Kutch, Gulf of Mannar, Lakshadweep and Andaman and Nicobar Islands.

- **Deccan**

A few natural wetlands, but innumerable small and large reservoirs and several water storage tanks in almost every village in the region.

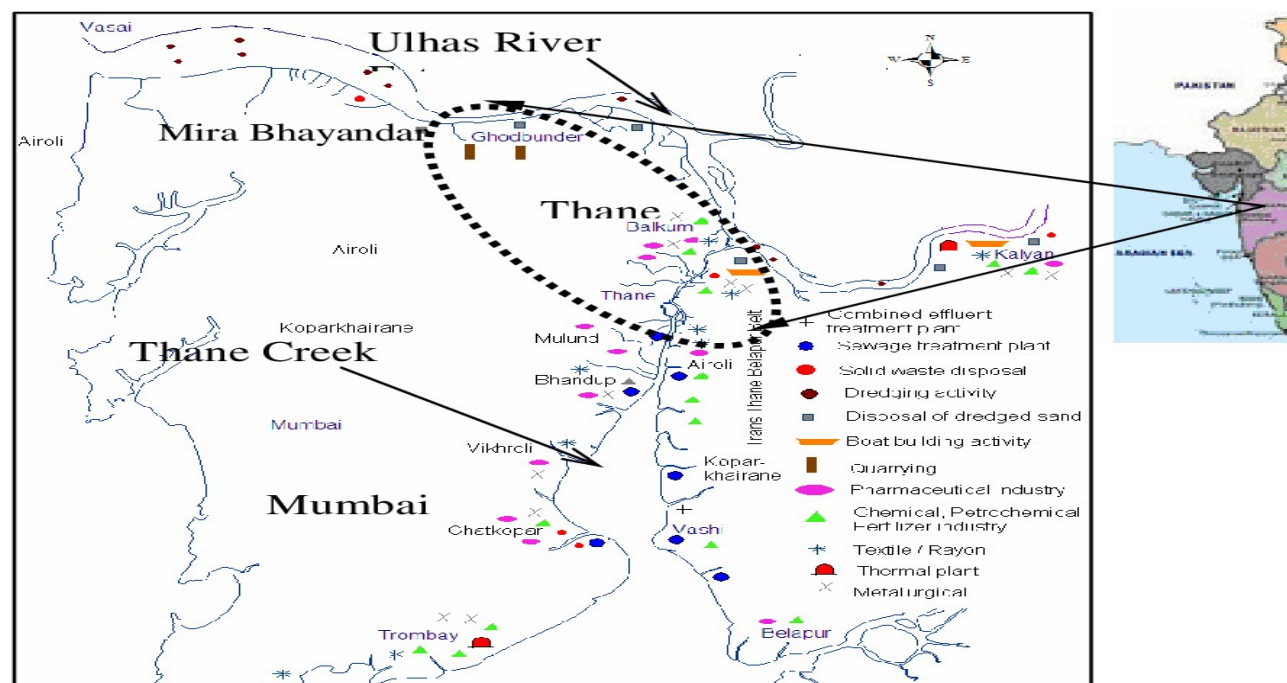


Freshwater in India support huge biodiversity in almost all taxa of plants and animals. Relative abundance of a species diversity in aquatic organism provide health of wetlands. Fresh water faunal biodiversity of India is 9456 species compared to the total world 128449 species(Chandra et al, 2018). Biodiversity of freshwater gives valuable goods and services for society. Conservation of them would assure the sustainability of them for future generation. But biodiversity loss is an indicator of unsustainable development.

Thane creek :

Thane creek is named after the adjoining city/ taluka/ district .Thane on its north where it meets the Ulhas river through a small connection to link it to the Mumbai harbour situated about 26 kms southwards. However, the Creek is said to extend from the river to the Vashi bridge about 12 kms to its south, beyond which the waters are said to be part of the Panvel and Dharamtar Creeks.

The river is the largest source of fresh water for the Thane creek besides numerous drainage channels from the suburban areas of Mumbai, Navi Mumbai and Thane. It is narrow and shallow at the river end and broader and deeper towards the sea and its boundary is defined by saltpans and stretches of mangroves (Birdlife International, 2004). Greater Mumbai and Mumbai suburban districts lie on the western bank of the Creek while Thane district lies on the mainland to its east. The Mumbai region with a number of industries on the west is highly urbanised not much unlike Navi Mumbai on its east with Asia's largest ThaneBelapur Industrial Area (TBIA).(Mendiratta,P and Gedam S.2014)



In the past few decades, there has been heavy growth of industries along the Creek which has led to dense urbanization in the area. (Athalye1988). According to the TMC-ES Report (2000), there are about 2000 industries along the Creek of which 51 are large, 250 medium and 1221 small industries. At the time of the report, among the industries, 10% are chemical industries, 63% engineering, 4% textile and pharmaceutical

and others 23% (Quadros, 2001). However, of late, there is a perceptible shift in the nature of industries, whereby the Chemical industries are giving way to Information Technology (IT) and corresponding business and commercial activities. Owing to the Government policies for promotion of this sector in the last decade, this change of land use towards the IT sector has resulted in increased construction activities in the study area. (Mendiratta, P and Gedam S. 2014)

The continuous development activities is observed on the flat land at these foothills leading to the Creek and the resulting formation of new lands through the gradual land cover and land use change by cutting of hill slopes and filling of low-lying wetlands areas owing to the consequent urbanisation pressures. Such development in parts of Mumbai and Navi Mumbai on both sides of Thane Creek results in substantial siltation, changing the land and drainage profile along it, especially in the last two decades.

Management of freshwater resources:

The preliminary step that has to be implemented in restoring wetlands for their long-term sustenance includes:

- Pollution impediment: Wastewater, solid and semi solid wastes entering in to the lake from external sources must be stopped before any restoration work is implemented.
- Harvesting of Macrophytes: Water hyacinth and other nuisance vegetation present in the lake, causing eutrophication, must be removed manually or mechanically. Weed infestation and biological control is an alternative
- Draining the water: Water present in the wetland must be cleaned or drained completely.
- Desiltation: Dredging of the sediments in the wetland to improve the soil permeability, water holding capacity and ground water recharge. Recent technological developments do permit wet dredging.
- Constructed Engineered Wetlands: A constructed wetland is a water treatment facility that has gained importance in recent years for treatment of wetland.

Key steps for best management practices include:

- Pollution alleviation practices to reduce the engendering of non-point source of pollution (mainly agricultural and storm runoff) through source reduction, waste minimisation and process control.
- Afforestation with native species in desolate areas around the wetland (catchment area) to control the entry of silt from runoff.
- The shorelines of the lakes are lined with bricks or stones in an attempt to control

Shorelineerosion.

- Constructed wetlands for the purpose of stormwater management and pollutant removal from the surface water flows.
- Infiltration trenches for reducing the storm water sediment loads to downstream areas by temporarily storing the runoff.
- Extended detention dry basins for removing pollutants primarily through the settling of suspended solids.
- Gyration of crops rather than monocultures to reduce the need for N and assist with pest control and help in aeration of soil.
- Promoting public education programs regarding proper use and disposal of agricultural hazardous waste materials and regular monitoring of lakes, which are rudimentary.

These restoration goals require profound planning, authority and funding along with financial resources and active involvement from all levels of organisation (Governmental and Non-Governmental Organisations (NGOs), research organisations, media, etc.) through interagency and intergovernmental processes all made favourable in innovating and inaugurating the restoration programs.

WETLAND PROTECTION LAWS AND GOVERNMENT INITIATIVES:

Wetlands do face the tragedy of commons, as is evident from present quality and steep decline in their numbers. The prime reason for this state is mainly due to lack of coordination among many agencies involved in the management and appropriate legal measures to protect these ecosystems. As on today, Wetlands are not delineated under any specific administrative jurisdiction.

Some wetlands are protected after the formulation of the Wildlife Protection Act. However, it is ineffective and most are in grave danger of extinction. Effective coordination between the different ministries, energy, industry, fisheries revenue, agriculture, transport and water resources, is essential for the protection of these ecosystems.

Prevailing laws are ineffective as far as the protection or conservation of aquatic ecosystems are concerned as most of them indirectly touch wetland protection: (Parikh & Parikh 1999)

- The Indian Fisheries Act - 1857
- The Indian Forest Act - 1927
- Wildlife (Protection) Act - 1972
- Water (Prevention and Control of Pollution) Act - 1974
- Territorial Water, Continental Shelf, Exclusive Economic Zone and other Marine Zones Act - 1976

- Water (Prevention and Control of Pollution) Act - 1977
- Maritime Zone of India (Regulation and fishing by foreign vessels) Act - 1980
- Forest (Conservation) Act - 1980
- Environmental (Protection) Act - 1986
- Coastal Zone Regulation Notification - 1991
- Wildlife (Protection) Amendment Act - 1991
- National Conservation Strategy and Policy Statement on Environment and Development -1992

Recommendations:

- India, in spite of being a signatory to the Ramsar Convention on Wetlands and the Convention of Biological Diversity, there is no significant development towards sustaining these ecosystems, either due to lack of coordination among agencies involved or lack of awareness of the values of wetlands among the policy makers and implementation agencies.
- The effective management of these wetlands requires a thorough appraisal of the existing laws, institutions and practices. The involvement of various people from different sectors is essential in the sustainable management of these wetlands.
- Apart from government regulation, better monitoring mechanisms are needed to increase the knowledge of the physical, chemical and biological characteristics of wetland resources, their values and a better understanding of wetland dynamics.
- For sustainable development of freshwater resources, it would be important to enable individuals and communities to appreciate their options, evaluate them and then choose the one that is the most appropriate.
- Water is a major factor in each of the three pillars of sustainable development – economic, social, and environmental.
- Management based on accurate knowledge and increased awareness of wetland issues involving all stakeholders and all components of ecosystem help in long term sustenance involving restoration and conservation. This would enhance the function and value of the system in terms of natural and socioeconomic factors to satisfy critical resource needs of the human population.
- Interstate disputes are a threat to peace as well use of water. A new water revolution is needed to preserve, harness, develop and manage water resources keeping in view both their quantity and quality.

Conclusion:

India, a megadiverse, second most populated country we have much ground to be covered in our conservation efforts of wetlands for the availability of them for food and goods for future generation and sustainable development

References:

1. Athlye, RP,(1988)status of Macrobenteroies Detritus food chain of Thane creek near Thane city. Phd. Thesis University of Bombay .pp 197.
2. Quadros, Goldin I 2001; Study of Intertidal Fauna of Thane Creek, PhD Thesis, Mumbai University. pp 15.
3. T. V. Ramachandra and N. Ahalya, 2001. Wetlands Restoration and Conservation. Proceedings of National Conference on 'Control Of Industrial Pollution and Environmental Degradation'. Department of Civil Engineering, PSG College of Technology, Coimbatore, September 14th and 15th 2001, pp 262-275
4. DeRoy, R. & Hussain, S. A. (Eds). 1993. Directory of Indian Wetlands. WWF-India, New Delhi and Asian Wetland Bureau, Kuala Lumpur. 240 pp..
5. Mitsch, W.I. & I.G. Gosselink. 1986. Wetlands. Van Nostrand Reinhold, New York.
6. Ramsar Hand Book 2016.An introduction to Ramsar Convention on wetlands 5th Edition.https://www.ramsar.org/sites/default/files/documents/library/handbook1_5ed_introductiontoconvencion_e.pdf
7. Kailash Chandra, K.C. Gopi, D.V. Rao, Valarmathi, J.R.B. Alfred 2018. Current Status of Freshwater Biodiversity of India: An Over View. 25pages.
8. Priya Mendiratta and Shirish Gedam.2014.The dynamic land form - Thane creek and its profile. An over view. Conference paper. Centre of Studies in Resources Engineering (CSRE), Indian Institute of Technology Bombay (IITB), Powai, Mumbai, India..5pages.

WETLAND CONSERVATION FOR SUSTAINABLE BIODIVERSITY

Komal R Shukla¹, Smruti V Bukane² and Jyothi V Mallia, Ph. D³,

^{1&2} SY BSc student & ³ Assistant Professor,

Department of Zoology, SICES Degree College, Ambernath (W)

Email id: jyothivmallia@gmail.com/shuklakomal1505@gmail.com/ bukanesmru16@gmail.com

Abstract:

Wetlands are most productive ecosystem in the world, which give habitat for thousands of species of aquatic and terrestrial plants and animals. These wetlands provide numerous ecological goods and services but are under tremendous stress due to various reasons such as rapid urbanisation, increase in pollution, climate change, greenhouse effect etc. World-wide scientists are looking at the ecological and hydrological impact resulting due to climate change on wetlands. It is expected that climate will have a pronounced effect on wetlands through alterations in hydrological regimes. Climate change can make future efforts to restore and manage wetlands more complex, so It is important to recognise that specific habitat for restoration and management.

In the present paper we highlight the effects of climate change on wetlands. We also discuss about conservation strategies for sustainable biodiversity.

Keywords: - Wetland, conservation, Restoration, Sustainable biodiversity, Hydrological regimes

Introduction

What are wetlands? Any part of our landscape having water body is called Wetlands. They are having significant role in our environment. Wetlands helps to reduce the pollutants by wave action and reduce the impacts of flood and improve quality of water. Wetlands are the site of high biodiversity and hence in the present paper we are going to discuss about the importance of wetlands and and their significance on maintaining balance in environment. Now a day's wetlands are facing many threats of which most critical one is climate change

Methodology

This paper is based on the review of literature based on wetlands and climate change

Discussion

Wetlands covers almost 6% of world's land surface and 12% of the global carbon pool. Wetlands are broadly defined as a variety of shallow water bodies and high ground water environment that are characterized by permanent or temporary inundation, soil and hydric properties , and plants and animals that have adapted to life in saturated condition. (Erwin.K.L,(2008)) Wetlands cover nearly 10% of the earth's surface of which 2% are lakes ,30% of bogs ,26% of fens , 20% of swamps and 15% of floodplains , mangrove further covers some 24 million hectare (ha) and coral reefs are estimate to cover 60 million ha (Ramsar 1998).

Wetlands system are vulnerable and particularly acceptable to change in quality and quantity of water supply(Erwin.K.L,(2008)) It appears that climate change may have it's more pronounced effect on wetlands through ultrafiltration in hydrological regimes. Hydrological regimes refer to variations in the state and characteristic of water bodies which are regularly repeated in time and space and which pass through phases. Although we have made much progress on the font of the issue of climate change may present greater challenges to conservation and restoration of wetlands, the task of restoration and conservation is made more difficult in light of the demand for water worldwide that has more than triple since 1950 and is projected to double again by 2035(Erwin.K.L,(2008))

Climate change effect on wetlands

Climate change will affect the hydrology of individual wetland ecosystem. Mostly through changes in precipitation and temperature regimes with variability (Bergkamp and Orlando, (1999)).Climate change may also

leads to shift in the geographical distribution of wetlands and an increase in the severity and extent of coral reefs bleaching and mortality, which can cause Storm, erosion of shores and habitat, increase in salinity of water, altered tidal ranges of rivers and lakes, change in sediment of nutrients transport and also can cause coastal flooding. It is also reported that Climate change can also effects wetlands through Sea level rise, Increase sea temperature, Increase temperature in tundra and Polar areas, Land use change, Water consumption patterns will accentuate climate impacts on wetlands

Water demand is projected to increase steadily during the coming decades. However, climate change is expected to lead to a decrease in water availability, especially in arid and semi-arid areas. To address this problem, many countries will need to continue efforts to increase reservoir storage capacity to meet the increasing demands for irrigation.

There is growing scientific understanding that the conservation and wise use of wetlands can no longer be achieved without taking climate change into account. An important element in climate change adaptation is the need to acquire more water storage capacity to buffer adverse effects.

Carbon sequestration

wetlands contribute about 40% of the global methane (CH₄) emissions, they have the highest carbon (C) density among terrestrial ecosystems and relatively greater capacities to sequester additional carbon dioxide (CO₂). Restoration of wetlands can reverse them to a sink of atmospheric CO₂ (Lal 2008). As per the estimations, carbon sequestration potential of restored wetlands (aver 50 year period) comes out to be about 0.4 tonnes C/ha/year. Overall, mangroves are able to sequester about 1.5 metric tonne of carbon per hectare per year, mangroves were also found to be emitting methane (CH₄), one of the primary greenhouse gases, which was around 19% of their carbon sequestration potential. Thus more research is required to ascertain whether wetlands can be managed as net carbon sinks over time and their potential role in climate change mitigation and international carbon trading system (Bassi.N, et al (2014))

Hydrological effects

Climate change is projected to intensify the global hydrological cycle and to have major impacts on regional and temporal water distribution and availability. One of the areas most vulnerable are those where precipitation currently is mainly in the form of winter snowfall and stream-flow comes largely from spring and summer snowmelt. In these areas, a temperature increase is likely to induce an increased winter runoff and a reduced spring and summer flows. For some of these areas, this would mean an increased risk for late winter

flooding and the likelihood of reduced availability of irrigation water during periods of high demand . The changes in runoff would, however, not only depend on changes in precipitation, but also on the physical and biological conditions within the catchment(Bassi.N, et al (2014))

Change in temperature of wetland bodies.

Increasing temperatures globally are likely to result in a warming of water temperatures in lakes and rivers. The greatest effect would be at high latitudes where biological productivity would increase and in low-latitude boundaries of cold- and cool-water species ranges and where extinction would be greatest . Rare and endangered plant and animal species with sensitivity to small temperature changes often have no alternative habitat, especially in isolated areas such as those in montane and alpine wetlands. Besides the warming effect, have pointed to the possibility of increased mixing of stratified water bodies due to increased storm activity, which could result in the large-scale die-off of fish species.

Wetland Conservation& Restoration

Erwin.K. L (2008),Ramchandra.T.V,(2001) and USEPA, 2000.gave few recommendations to restore the wetlands like implementing sustainable ecosystem management plans, as human being continue to work on the task of reducing CO₂ emissions and reversing existing climate change trends. These gave a new direction for global wetland conservation in a changing world

Few of them are

- Need to quickly train restoration scientists and practitioners.
- Need to monitor, design and implement wetland restoration and management projects globally on a large scale..
- Monitoring Invasive species and to take precaution for their impacts on natural ecosystem as rapidly changing climates and habitats may increase opportunities for invasive species to spread because of their adaptability to disturbance.
- Development of a water quality database, accessible to all users, for analyzing and disseminating information.
- Exchanging data across departments involved in the program to allow easy accessibility to regularly and continuously monitored data;

- Updating technical guidance and water quality maps at regular intervals and indicating quality determinant parameters;
- Analyzing and discussing case studies of water quality issues
- Providing spatial, temporal, and non-spatial water quality database systems.
- Restore native species and avoid non-native species.
- Restore ecological integrity, natural structure and function and wetland ecosystem

According to Ramchandra.T.V(2001) wetland management program generally involves activities to protect, restore, manipulate, and provide for functions and values emphasizing quality and sustainable usage. It requires joint effort by various agencies such as state departments concerned with the environment, soil, agriculture, forestry, urban planning and development, natural resource management; public interest groups; citizen's groups; research institutions; and policy makers. Such management goals should not only involve buffering wetlands from any direct human pressures that could affect their normal functions, but also in maintaining important natural processes operating on them that may be altered by human activities. Wetland management has to be an integrated approach in terms of planning, execution, and monitoring, requiring effective knowledge on a range of subjects from ecology, hydrology, economics, watershed management, and local expertise,

Ramsar Convention is one organization which is working so hard from so many years to save wetlands, they are setting an perfect example all over world wide for whole world by there work. (Ramsar Hand book, 2016)

Conclusion:

- Wetlands response to climate change are poorly studied
- Although we have made much progress on the front of the issue of climate change may present greater challenges to conservation and restoration of wetlands, the task of restoration and conservation is made more difficult in light of the demand for water worldwide that has more than triple since 1950 and is projected to double again by 2035
- To address this problem, many countries will need to continue efforts to increase reservoir storage capacity to meet the increasing demands for irrigation.
- There is growing scientific understanding that by taking climate change into account the conservation and wise use of wetlands have to be achieved
- It is a need to acquire more water storage capacity to buffer adverse effects as a adaptation towards change in climate

- Thus, more research is required to ascertain whether wetlands can be managed as net carbon sinks over time and their potential role in climate change mitigation and international carbon trading system.

Acknowledgement

We acknowledge Management and I/c Principal of SICES College for the support.

References

1. Kevin L. Erwin, 2008. Wetlands and global climate change: the role of wetland restoration in a changing world, 14 pages
2. Paula Meli, José María Rey Benayas, , and Miguel Martínez Ramos 2014 .Restoration Enhances Wetland Biodiversity and Ecosystem Service Supply, but Results Are Context-Dependent: A Meta-Analysis.
3. G. Bergkamp & B. Orlando. 1999. Wetlands and Climate Change Exploring collaboration between the Convention on Wetlands (Ramsar, Iran 1971) and the UN Framework Convention on Climate Change, October 22 pages
4. Nitin Bassi, M. Dinesh Kumar, Anuradha Sharma, P. Pardha-Saradhi, 2014. Status of wetlands in India: A review of extent, ecosystem benefits, threats and management strategies , 19 pages Department of Environmental Studies, University of Delhi, Delhi 110007, India Institute for Resource Analysis and Policy (IRAP), Hyderabad, India Department of Botany, Hindu College, University of Delhi, Delhi, India ,
5. Jyoti Parikh and Hemant Datye 2003 Sustainable management of wetlands: biodiversity and beyond Sage Publications India, 19 pages book pdf.
6. Ramachandra, T.V . 2001 Restoration And Management Strategies Of Wetlands In Developing Country Journal Electronic Green Journal, 1(15) , 18 pages
7. A.J. Hails. 1997 Wetlands, Biodiversity and the Ramsar Convention: the role of the Convention on Wetlands in the Conservation and Wise Use of Biodiversity , edited by Ramsar Convention Bureau Ministry of Environment and Forest, India, 1996 [1997] Published by the Ramsar Convention Bureau , Glands, Switzerland
8. Ramsar Hand Book 2016. An introduction to Ramsar Convention on wetlands 5th Edition. https://www.ramsar.org/sites/default/files/documents/library/handbook1_5ed_introductiontoconvencion_e.pdf
9. USEPA, 2000. *Principles for the Ecological Restoration of Aquatic Resources*. EPA841-F-00-003. Office of Water (4501F), United States Environmental Protection Agency, Washington, DC. 4 pp.

10. [V. Burkett](#) and [j. Kusler](#).2007.climate change: potential impacts and interactions in wetlands of the unttd states of the *journal of the american water resources association* paper no. 99079.<https://doi.org/10.1111/j.1752-1688.2000.tb04270.x>

Climate change, Water Crises and Wetlands

Pranali Ranshur, SPDC

ABSTRACT:- Wetlands are one of the most important ecosystems on Earth. Wetlands give us countless benefits or “ecosystem services” which provide humanity, ranging from freshwater supply, food & building materials, & biodiversity, to flood control, soil erosion control, groundwater recharge, & climate change mitigation. Forests are considered the lungs of the Earth, Wetlands can be referred to as “Earth’s kidneys”, absorbing harmful pollutants like Carbon Dioxide & Nitrogen. So the ball is in your court which will you choose Wonderful Wetlands or Waste Wetlands.

KEYWORDS:- Kidney of Earth, Natural Sponge, Soil erosion control, Water Crisis , National Wetland Atlas , Ramsar Conservation, Classification & Types , Conservation Award Winners, Pantanal, Chilika Lake , Nandur Madhmeshwar Niphad, Dhruvansh, Protection Laws & Acts , India Ramsar Sites.

INTRODUCTION:- World Wetlands Day is celebrated every year on 2nd February. Only 2.5% of water on earth is freshwater. Less than 1% is usable rivers, lakes and swamps are essential surface water sources. Wetlands defined as areas of land that are either temporarily or permanently covered by water exhibit enormous diversity Acc. to their genesis, geographical location, water regime & chemistry. Wetlands are a productive ecosystem & play an important role in the hydrological cycle. -National Wetland Atlas. “Wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water i.e. static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres”. - Ramsar Conservation.

CLASSIFICATION OF WETLANDS: - 1) **MARINE WETLAND :-** These wetlands are saltwater wetlands exposed to waves, currents and tides in an oceanic setting. i) Saline Water Wetland. ii) Brackish Wetlands.

2) **INLAND WETLAND:-** Inland wetlands such as floodplains, rivers, lakes and swamps function like sponges, absorbing and storing excess rainfall and reducing flood surges. i) **Freshwater Wetlands:-** They are not connected to the ocean. It can be found along the boundaries of streams, lakes, ponds or even in large shallow holes that fill up with rainwater. ii) **Brackish wetlands** are places where saltwater and freshwater mix.

3) **MAN- MADE WETLANDS:-** Human- made wetlands such as fish, shrimp & farm ponds, irrigated agricultural land, salt pans, reservoirs, gravel pits, sewage farms & canals.

FIVE TYPES OF WETLANDS:- • Marine (coastal wetlands including coastal lagoons, rocky shores & coral reefs). • Estuarine (including deltas, tidal marshes, & mangrove swamps). • Lacustrine (wetlands associated with lakes). • Riverine (wetlands along rivers & streams). • Palustrine (meaning “marshy” - marshes, swamps and bogs).

WHY WETLANDS ARE IMPORTANT? Wetlands are essential for human survival. Wetlands provide habitat for thousands of species of aquatic and terrestrial plants and animals. Wetlands play a very important role in flood protection, water quality, soil erosion control, recreation etc.

WATER CRISIS :- India has about 757,060 wetlands, with a total wetland area of 15.3 million hectares, accounting for nearly 4.63% of the total geographical area of the country. Water covers 70% of our planet. However, freshwater we drink, bathe in, irrigate our farm fields is incredibly rare. Only 3% of the world's water is freshwater, and two-thirds of i.e. tucked away in frozen glaciers. i) Population growth, urbanization & consumption patterns have put unbearable pressure on wetlands & the water in them. ii) 2.2 billion people don't have safe drinking water with an annual income cost. iii) Water in security was a key factor in conflict in at least 45 countries in 2017. iv) 14% more water is needed to produce 70% more food by 2050 for 10 billion people.

CLIMATE CHANGE WILL AFFECT WETLANDS THROUGH:- i) Global Greenhouse Gas Emissions. ii) Melting Glaciers adds to rising Sea Levels. iii) Increased sea temperature & wetland water bodies & also Increase temperature in Tundra & Polar Areas. iv) Soil Erosion, Mud Landslide Damage & Decreased water resource "QUANTITY & QUALITY". v) Changes in Hydrology & also change in Water Cycle Pattern. **SOME CASES WHERE THIS CLIMATE CHANGE HAPPENS:-** a) Mumbai Flood 2005. b) Bellandur Lake in Bengaluru. c) Mud Landslide in Pune 2014. d) Nisarg Chakri Vadal in Mumbai 2020. e) Cyclone Vardah in 2020. Just as forests are called the 'Lungs of the Earth', Wetlands are the 'Kidneys' that regulate water and filter waste from the landscape.

ROLES OF WETLANDS :-

I) WETLANDS ARE NATURAL SPONGE THAT ABSORB & STORE CARBON:- Peatlands, mangroves, & seagrass meadows are the carbon sinks on Earth, since they absorb & store vast amounts of carbon. Peatlands cover about 3% of our planet's land, but they store approximately 30% of all land-based carbon, i.e. twice the amount than all the world's forests combined.

II) WETLANDS ARE NATURAL SHOCK ABSORBERS:- Wetlands protect coastlines from extreme meteorological events. Salt marshes, mangroves, seagrass beds and coral reefs act like shock absorbers. They reduce the intensity of waves, storm surges, & tsunamis, shielding the 60% of humanity who lives & works along coastlines from flooding, property damage and loss of life. Wetlands reduce floods & relieve droughts. This has the effect of trapping & slowly releasing water that would otherwise rush into the channel and contribute to flooding downstream.

WHAT ARE THREATS TO WETLAND? Wetlands are threatened by reclamation & degradation through drainage & landfill, pollution, hydrological alteration, over-exploitation of natural resources resulting in loss of biodiversity, disruption in ecosystem services & unsustainable development. **HERE ARE SOME**

NAMES OF WORLD'S FAMOUS WETLAND :- i) Pantanal Wetland World's Largest Wetland in Brazil. ii) Chilika Lake in Orissa which is 1st Ramsar site in India. iii) Nandur Madhmeshwar Nipad (Nashik) which is the 1st wetland site in Maharashtra. The Ramsar Wetland Conservation Award honours the work of governments, organisations & individuals in promoting the wise use & conservation of wetlands. i) Ms. Giselle Hazzan Israel wins Ramsar Wetland Conservation Award in 2015. ii) Mr. Ma Guangren from China also won the Ramsar Wetland Conservation Award in 2018. India's Largest Floating Treatment Wetland At Neknampur Lake in Hyderabad Invented by "DHRUVANSH, an NGO".

WHAT ARE THE BENEFITS OF WETLANDS:- •Store & Clean Water. •Sea level rise mitigation. •Flood Control & Storm Buffer. •Fertile FarmLand. • Recreation Tourism.

WETLAND PROTECTION LAWS AND GOVERNMENT INITIATIVES :- The guidelines clarified that all wetlands, irrespective of their location, size, ownership, biodiversity, or ecosystem services values, can be notified under the Wetlands Rules 2017, except river channels, paddy fields, human-made water bodies specifically constructed for drinking water, aquaculture, salt production, recreation, irrigation purposes, wetlands falling within areas covered under the:- • Indian Forest Act, 1927, •Forest (Conservation) Act, 1980, •Wildlife (Protection) Act, 1972 •The Coastal Regulation Zone Notification, 2011. There are 2,414 Ramsar sites in the world, covering 254,543,971.597 hectares. Any wetland site which is listed under the Ramsar Convention is called a Ramsar site. There are a total of 42 Ramsar Sites in India.

LIST OF RAMSAR SITE IN INDIA:- 1)Asan Conservation Reserve- Uttarakhand. 2)Ashtamudi Wetland;Sandi Bird Sanctuary;Sasthamkotta Lake;Vembanad Kol Wetland - Kerala. 3)Beas Conservation Reserve; Harike Wetlands;Keshopur-Miani Community Reserve ;Nangal Wildlife Sanctuary ;Kanjli Wetland ;Ropar Wetland - Punjab. 4)Bhitarkanika Mangroves; Chilika Lake - Odisha. 5)Bhoj Wetlands- Madhya Pradesh. 6)Chandra Taal;Pong Dam Lake;Renuka Lake -Himachal Pradesh. 7)Deepor Beel -Assam. 8)East Kolkata Wetlands;Sundarbans Wetland- West Bengal. 9)Hokera Wetland; Surinsar- Mansar Lakes;Tsomoriri; Wular Lake - Jammu and Kashmir. 10)Kabartal Wetland - Bihar. 11)Keoladeo Ghana National Park- Rajasthan. 12)Kolleru Lake- Andhra Pradesh. 13)Loktak Lake- Manipur. 14)Lonar Lake;Nandur Madhyameshwar- Maharashtra. 15)Nalsarovar Bird Sanctuary - Gujarat. 16)Point Calimere Wildlife and Bird Sanctuary- Tamil Nadu. 17)Rudrasagar Lake -Tripura. 18)Saman Bird Sanctuary ;Samaspur Bird Sanctuary;Sarsai Nawar Jheel;Sur Sarovar ;Nawabganj Bird Sanctuary ;Parvati Agra Bird Sanctuary;Upper Ganga River- Uttar Pradesh. 19)Sambhar Lake- Rajasthan. 20)Tso Kar- Ladakh.

ACKNOWLEDGMENT:- I would like to express my gratitude to All My Respected Teachers as well as our Principal Dr. Hemant K. Chitte Sir & also Paryavaran Dakshata Mandal who gave me this opportunity to participate on Wetland competition under conference on the topic of Climate Change, Water Crises and Wetlands. Lastly, I would especially like Thanks to My Parents who support me throughout my competition.

CONCLUSION:-

- Wetlands are important for human beings because they provide important ecological and social-economic services.
- Wetlands are the homes for beautiful & rare species for both terrestrial & amphibian organisms. •Wetlands Are Kidneys of our Earth,& Acts as Natural Sponge which absorbs carbon ; to retain flood waters & to protect shorelines from soil erosion.
- The Loss of Wetlands puts in dangers to All living-organisms.
- There is Only one way to Conserve Wetlands is to create General Awareness among people by starting small campaigns ,giving information about wetlands like in T.V advertisements, also by making posters of wetland conservation protects laws & conservation acts .
- Last but not the least "SAVE DON'T PAVE WETLANDS".

REFERENCES:- 1)www.google.com

- 2) www.ramasar.org
- 3) National Wetland Atlas-<http://saconevis.nic.in> or sacon@envis.nic.in
- 4) <https://en.m.wikipedia.org/wiki/Wetland>
- 5) <https://www.thebetterindia.com/129968/india-floating-island-hyderabad-lake/>
- 6) https://www.usgs.gov/faqs/why-are-wetlands-important?qt-news_science_products=0#qt-news_science_products
- 7) http://wgbis.ces.iisc.ernet.in/energy/water/paper/wetlands_restoration_conservation/protection.htm
- 8) <https://www.slideshare.net/mobile/indiawaterportal/wetlands-of-india-2-7813634>
<https://medwet.org/2018/12/world-wetlands-day-2019/>
- 9) <https://www.ramsar.org/activity/world-wetlands-day-2016>
- 10) <https://unfccc.int/news/wetlands-disappearing-three-times-faster-than-forests>
- 11) <https://scroll.in/article/949988/indias-guidelines-on-wetlands-will-allow-states-to-decide-what-cou>

Climate change, Water crisis and Wetlands

Name:- Govinda Hira Rathod Class:- T Y B Sc Roll no. 57

College:- Satish Pradhan Dnyansadhna college, Thane.

Wetlands are essential or not? And why should we conserve wetlands? Is climate change is affecting wetlands? Without wetlands what will happen? To answer all this questions I have did study on climate change, Water crisis and Wetlands.

- Wetlands are the interface between terrestrial and aquatic ecosystem. Wetland is the land covered by shallow water. Wetlands are typically low lying areas. Wetlands are called as a nature's Kidney.
- **What wetlands do for us:-**Wetlands supports our social and economic development through multiple services as follows.
 1. **Purify water:-**Wetlands hold and provide most of our fresh water. It is a natural filter / purifier.
 2. **Provide nature a home:-** 40% Of the world's species live and breed in wetlands. Hence supporting biodiversity.
 3. **Absorb and store carbon:-** Wetlands absorb CO₂ from the air and produce 'O' through photosynthesis.
 4. **Flood Protection:-** Wetlands function as a natural sponge that trap and slowly release surface water, flood water & protect us.
 5. **Nature's shock absorbers:-** Reduce the speed and height of storm surges.
 6. **Create sustainable development and livelihoods:-**Keep us feed. Provided 12 million of fish in 2018. Rice paddies feed 3.5 billion people annually.

➤ **Climate change and Wetlands:-**

The wetlands are giving us so many beneficiary things which are essential for life. But **“What we are giving to these natural resources?”** We are giving only pain and destroying such natural resources. Climate change is increasing day by day creating a global warming effect because of our human's selfish nature. We think about ourselves only and not even think about the environment which creating the problems today due to Pollution, Urbanization, Deforestation, etc.

❖ **Impacts of climate change on wetlands:-**

- Degradation & loss of wetlands.
- Alter ecological process.
- Severe storm events.
- Altering the benefits of wetlands.
- Mangroves are reduced.
- Sea level rise and Change in flood pulse.

❖ **Wetland loss impact:-Climate change has put unbearable pressure on wetlands.**

- 25% of all wetlands species are in facing extinction.

- 1 in 3 freshwater species are in danger.
- Climate change is reducing surface and groundwater in already dry regions.
- Resulting in increasing competition for Water.

Are you aware of that if wetlands will be loss then what will happen? The simple answer is water crisis.

❖ **Did you know?**

Wetlands preserve water quality by removing nitrogen, phosphorous and pesticides from agricultural runoff. Chemicals and nutrient can enter into wetlands through surface water and sediment, or through ground water. Nitrate is efficiently removed from wetlands surface waters by aquatic plants of wetlands. Hence wetlands are also called as nature's kidney.

❖ **Water crisis condition without Wetlands:-**

- Water crisis will be increasing.
- Without wetlands, the cities have to spend more money to treat water for their citizens.
- It can create the global water crisis and commoditization of water.
- There is no doubt that if this scenario continues the water will become blue gold and commoditization of water will be happen in future.

❖ **Without wetlands the Global warming condition:-**

1. 90 % of the world's wetlands lost since 1700's
2. Wetlands are disappearing three times faster than forest's.
3. If wetlands are drained, burned or cleared they become a carbon source which will release into atmosphere.
4. CO₂ emission from this drained and burned peatlands is equal to about 10% of global annual fossil fuel emission.
5. Which can increase the risk of global warming effect?

❖ **What we can do?**

For conservation of such a blissful natural resources like wetlands we can do some small steps which be helpful to preserve wetlands

- Stop destroying the wetlands.
- Start restoring the wetlands.
- Address pollution and integrate it into development.
- Don't spill chemicals or gas near wetlands.
- Do not leave water running.
- Don't put ATP to close to wetlands.
- More important thing is that spread awareness about the wetlands its importance for our sustainable development.

Sustainable Development of Wetlands for Water Crisis Management

Suresh T. More¹, Dinesh N. Navale^{*}

stm.vpmkchem@gmail.com, dineshnavale@gmail.com

¹Department of Chemistry, Arts Commerce and Science College, Kinhavali, Thane-421403


^{*}Department of Chemistry, VES College of Arts, Science and Commerce, Sindhi Society, Chembur, Mumbai-400071

Abstract-India has around near about 757,060 wetlands, with an absolute wetland zone of about 15-16 million hectares, representing almost 4-5 % of the all over geological region of the nation. None of the 28 states and 8 Union regions has advised their wetlands, which are basic for groundwater revive and putting away rising waters during spillover occasions, as ordered under Wetland Rules 2017, shows government information. On the off chance that wetlands are not informed, they stay defenseless against infringement or mechanical contamination, which could, thusly, limit water stream and groundwater revive. On the off chance that you take a gander at the environmental change situations anticipated, downpours might be in same amount yet there is a probability of an expansion in serious short spells. All things considered we need to store surface overflow in wetlands can be the best cradle for extraordinary environmental change impacts.

Keywords- Wetlands, Water crisis, Groundwater revive etc.

References:-


1. Gardner, R.C. Barchiesi, S. Beltrame, C. Finlayson, C.M. Galewski, T. Harrison, I. Paganini, M. Perennou, C. Pritchard, D.E. Rosenqvist, A. and Walpole, M. 2015. (2015). State of the World's Wetlands and their Services to People: A compilation of recent analyses. Ramsar Briefing Note, no. 7(June), 1-20. <http://doi.org/10.2139/ssrn.2589447>.
2. Birhan, M.Sahlu, S., &Getiye, Z. (2015). Assessment of Challenges and Opportunities of Bee Keeping in and Around Gondar, 8(3), 127-131.
3. BekeleTonaAmenu, GetahunShankoMamo (2018). Review on Wetland Ecosystem Destruction 2018 IJSRCE / Volume 2 /Issue 2 / ISSN : 2456-6667



Sustainable Development of Wetlands for Water Crisis Management

Suresh T. More¹, Dinesh N. Navale^{*}
stm.vpmkchem@gmail.com, dineshnavale@gmail.com

¹Department of Chemistry, Arts Commerce and Science College, Kinhavali, Thane-421403
^{*}Department of Chemistry, VES College of Arts, Science and Commerce, Sindhi Society, Chembur, Mumbai-400071



V.E.S.
Since 1962

Abstract: India has around near about 757,060 wetlands, with an absolute wetland zone of about 15-16 million hectares, representing almost 4-5 % of the all over geological region of the nation. None of the 28 states and 8 Union regions has advised their wetlands, which are basic for groundwater revive and putting away rising waters during spillover occasions, as ordered under Wetland Rules 2017, shows government information. On the off chance that wetlands are not informed, they stay defenseless against infringement or mechanical contamination, which could, thusly, limit water stream and groundwater revive. On the off chance that you take a gander at the environmental change situations anticipated, downpours might be in same amount yet there is a probability of an expansion in serious short spells. All things considered we need to store surface overflow in wetlands can be the best cradle for extraordinary environmental change impacts.

Keywords: Wetlands, Water crisis, Groundwater revive etc.

Water Pollution can be anything from oil, to remains, to synthetic compounds, and fecal issue. Regardless of what it will be, it makes a great deal of issues for the individuals who may have to utilize it.

Drought is a region particularly hot and dry, which isn't persuading enough precipitation to have the option to support the existence that is living there.

Global warming: When our air temperature increases, due to that rivers and lakes water evaporated, which rises to water consumption.



Biodiversity conservation: wetlands give a climate where photosynthesis can happen and where the reusing of supplements can occur, they assume a critical part in the help of natural ways of life.

Flood control: Wetlands assume a significant part in flood control. Wetlands help to decrease the effects of flooding by retaining water and lessening the speed at which rising water streams.

Horticulture and associated areas: Wetlands, for example, tanks, lakes, lakes, and stores having water from different natural sources and their utilization take place in irrigation and other fields.

References:

1. Birhan, M. Sahlou, S., & Getiye, Z. (2015). Assessment of Challenges and Opportunities of Bee Keeping in and Around Gondar, 9(3), 127-131.
2. Bekele Tona Amenu, Getahun Shanko Mamo (2018). Review on Wetland Ecosystem Destruction 2018 *USRCE / Volume 2 / Issue 2 / ISSN : 2456-6667*

Conclusion:
It seems to be observed that now a days we people facing the measure issue of water crisis it can be resolve by proper utilization and protection of wetlands.

Climate Change, Water Crisis and Wetland

Ansari Iffat Shafique

Department of Chemistry,
Satish Pradhan Dnyanasadhana College, Thane

Abstract:

Wetlands cover approximately 6% of the Earth's surface. They are frequently found at the interface between terrestrial and aquatic ecosystems and are strongly dependent on the water cycle. For this reason, wetlands are extremely vulnerable to the effects of climate change. Mangroves and floodplain ecosystems are some of the most important environments for the Amazonian population, as a source of proteins and income, and are thus the types of wetlands chosen for this review. Some of the main consequences that can be predicted from climate change for wetlands are modifications in hydrological regimes, which can cause intense droughts or inundations. A possible reduction in rainfall can cause a decrease of the areas of mangroves and floodplains, with a consequent decline in their species numbers. Conversely, an increase in rainfall would probably cause the substitution of plant species, which would not be able to survive under new conditions for a long period. An elevation in water temperature on the floodplains would cause an increase in frequency and duration of hypoxic or anoxic episodes, which might further lead to a reduction in growth rates or the reproductive success of many species. In mangroves, an increase in water temperature would influence the sea level, causing losses of these environments through coastal erosion processes. Therefore, climate change will likely cause the loss of, or reduction in, Amazonian wetlands and will challenge the adaptability of species, composition and distribution, which will probably have consequences for the human population that depend on them.

Key words: global warming; wetlands; mangrove; floodplains; Amazonia



Wetlands and Management of Freshwater Resources

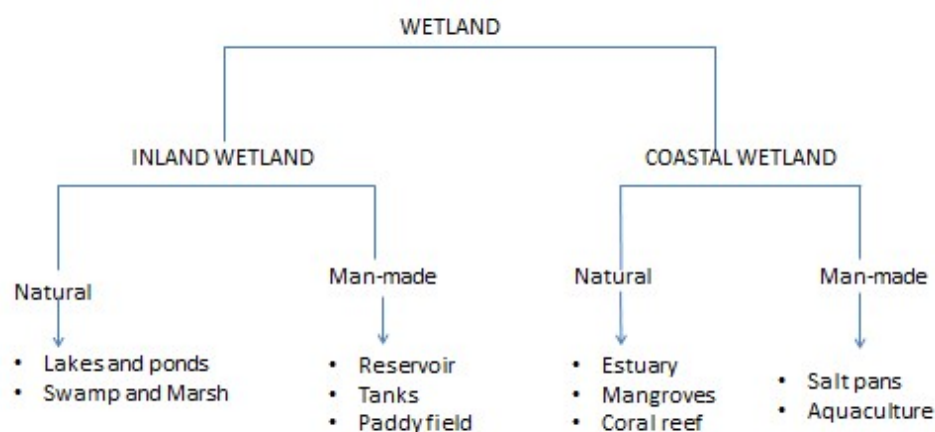
Ankita Das

“First, there is life in the water, by which everything else is made green”-

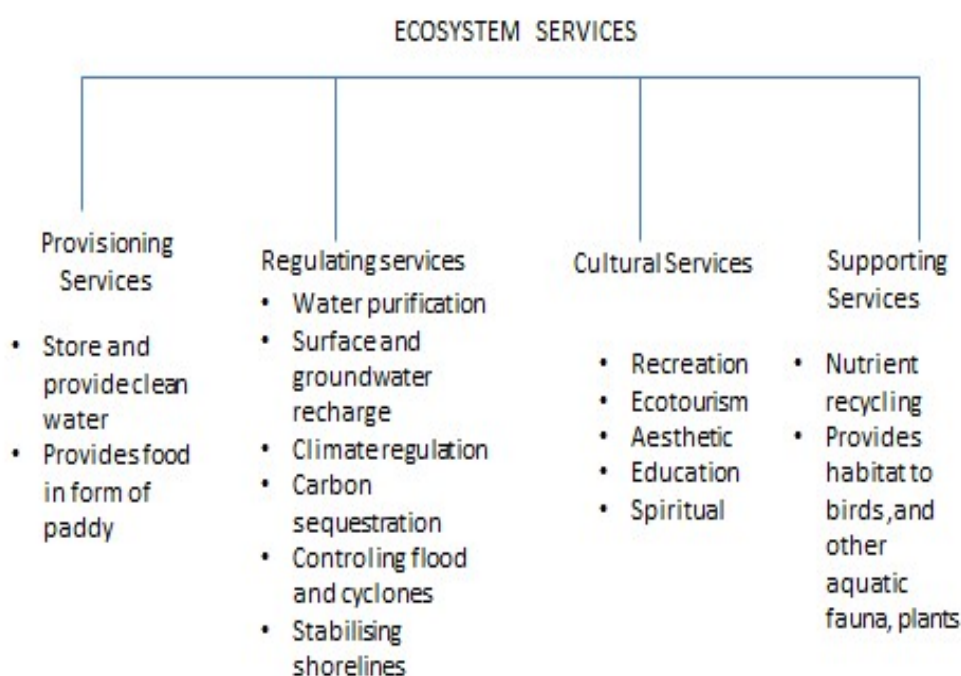
14 Aasaa Guru Nanak Dev.

Water represents the very essence of life. It is the elixir of life. Water is one of the five physical elements which is the basis of all cosmic creation. Wetlands and other freshwater sources is repository of water. Wetlands are cradle of civilization. They sustain humanity and nature.

Under the text of the Ramsar Convention (Article 1.1), wetlands are defined as: “Areas of marsh, fen, peatland 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 metres. According to Wetland International, wetlands are “Areas on which water covers the soil or if water is present either at or near the surface of that soil. Water can be present within the root zone, all year or just during various periods of time of the year.” India has great diversity of wetlands. It supports 1/25th of world’s water resources. It has 27,403 wetlands. Out of which 23,444 are inland wetlands and 3959 are coastal wetlands. Common forms of wetland found in India are:



“Wetlands and water” is the theme for Wetland Day 2021 which highlights the importance of wetland as source of freshwater and focusses on its restoration. Water and wetland are vital for our life and to the health of our planet and thus considered as arteries and veins of landscape. They are also rightly termed as Biological supermarkets and sometimes as kidneys of Nature. They are one of the highest productive life-support systems which have high ecological, economical, cultural, social, spiritual significance. Their ecosystem services are summarised as below:



“We never know the worth of water till the well is dry.”

-Thomas Fuller

Wetlands are fragile ecosystem and have become threatened. Recent year has seen its rampant exploitation. Our consumption is more than the earth can replenish it. 80% of the world’s wetlands have been lost globally in the last 300 years. It has lead to crisis of freshwater. As this ecosystem is degrading, the interlinked carbon and

nutrient cycle is also degrading, leading to water, food and climate insecurity. Some of the threats and the ways in which the wetlands and freshwater can be managed are:

Urbanisation

Wetlands were once considered wastelands and thus there was rampant construction of buildings and industries over it. Gradually it all leads to loss of wetlands and lead to water scarcity. The following ways can be adopted to manage water:

- Rainwater harvesting-
It is capturing rainwater to control the runoff. It is also the way to reduce the dependency on groundwater resources. It maintains the water table. It prevents soil erosion and flooding
- Pervious pavements should be used as it helps in the recharge of groundwater.
- Awareness programme should be there such as Jal chaitanyam (Water awareness programme) started by Andhra Pradesh Government.

Agriculture

Large scale development of irrigation and other agricultural activities has changed the hydrology of many waterbodies. The following ways should be used for water management:

- Sprinkler and drip irrigation should be used
- Uncontrolled use of bore wells should be avoided as it extracts groundwater at high rate
- Watershed management such as 'Hariyali' launched by Indian Central Government.

Eutrophication-

- Nutrient levels in water within catchments can be reduced by:
 - stripping phosphate from sewage effluent;
 - reducing fertilizer inputs;
 - minimizing leaching of sediment and nitrate into watercourses using vegetated filter strips/buffer strips
- Excessive growth of algae can be removed by mechanised weed harvester as done in Ansupa Lake (Odisha).

Pollution-

- Artificial wetlands can be created nearby factories and industries to treat effluents. Plants such as Typha, phragmites can work as potent wetland plants which can remove heavy metals.
- Bio-remediation is one of the promising method to treat waste water .This technique is used to treat sewage water mixing with the East Kolkata wetlands.

Biodiversity loss

The two principal methods of improving the value of deep water bodies (>1 m) for wildlife are by:

1. Making their margins shallower for emergent vegetation and other shallow-water plant species and associated fauna;
2. Providing islands or rafts for nesting water birds;
3. Fish ponds can be of high value for feeding water birds. The main way of increasing their value for birds is by ensuring they also contain suitable nesting habitat.

In temporary pools, which are water bodies that experience a recurring dry phase at a more or less predictable time of year, or else only fill with water intermittently

1. Should never be drained or deepened to create permanent water bodies.
2. Lengthening the period that pools hold water allows species with longer aquatic stages to complete their life cycles – Amphibians
3. Periodic drying out helps retain temporary pools in an early successional state.

Some vegetation removal is often necessary to preserve the characteristic, open nature of many temporary pools and prevent them from becoming dominated by tall and rank vegetation.

“For many of us, water simply flows from a faucet, and we think little about it beyond this point of contact. We have lost a sense of respect for the wild river, for the complex workings of a wetland, for the intricate web of life that water supports.”

-Sandra Postel

A wetland is more than a water carrying body. It also connects people and other forms of life, inspiring and sustaining diverse cultural beliefs, values, and ways of life. The call of the hour is sustainable management. If we ignore now it will be detrimental to the sustenance of humans and other variety of life. Their conservation will

determine our sustenance. It is the time to wash away our sins, but not in the holy water of wetlands but by taking and implementing appropriate conservation measures.

We must remember that “Water is life's matter and matrix, mother and medium. There is no life without water.”

-Albert Szent-Gyorgyi

नमभूमि और जल

आकृती तामरकर

प्रस्तावना

पृथ्वी को “नीला ग्रह” कहा जाता है। इस तथ्य को महसूस करने की जरूरत है कि पानी बहुतायत है, लेकिन यह सभी उपभोग करने के लिए सुरक्षित नहीं है। हमें न केवल अपने लिए बल्कि अपनी आने वाली पीढ़ियों के लिए भी जल संरक्षण की जरूरत है। जल की कमी एक सार्वभौमिक समस्या है। इस पृथ्वी के कुछ हिस्सों में, लोगों को शुद्ध पीने योग्य पानी इकट्ठा करने के लिए लंबी दूरी तय करनी पड़ती है। लेकिन इस धरती के अन्य हिस्सों में, लोग पानी के मूल्य को नहीं समझते हैं। कुछ साल पहले दुकानों में लोगों को शुद्ध पानी की बोतलें बेचते हुए देखना काफी चौंकाने वाला था। हालाँकि आज, जल संकट में वृद्धि के साथ, यह दृष्टि दुनिया के विभिन्न हिस्सों में काफी आम हो गई है। अनुमान है कि बोतलबंद पानी की कीमत 4 - 6 लाख करोड़ रुपये है जो हर साल दुनिया भर के लोगों द्वारा उपयोग किया जा रहा है। वैज्ञानिकों द्वारा किए गए हालिया अध्ययनों के अनुसार, अगर हम विवेकपूर्ण तरीके से पानी नहीं बचाते हैं, तो 2025 तक दुनिया भर में 30 करोड़ से अधिक लोग जल की कमी के संकट की चपेट में आ जाएंगे।

आर्द्रभूमि/ नमभूमि ऐसा भूभाग है जहाँ के पारितंत्र का बड़ा हिस्सा स्थाई रूप से या प्रतिवर्ष किसी मौसम में जल से संतृप्त हो, सामान्य भाषा में वेटलैंड ताल, झील, पोखर, जलाशय दलदल इत्यादि के नाम से जाने जाते हैं। आर्द्रभूमि एक विशिष्ट प्रकार का पारिस्थितिकीय तंत्र है तथा जैवविविधता का महत्वपूर्ण अंग है। 2 फरवरी 1971 को ईरान में रामसर में आर्द्रभूमि पर सम्मेलन आयोजित किया गया, जिसमें इसे अंतरराष्ट्रीय स्तर की मान्यता देने के पूर्व प्राणि विज्ञान, पारिस्थितिकीय, सरोवर विज्ञान व जलीय महत्व पर आधारित मानकों का चिन्हीकरण किया जाता है।

क्यों महत्वपूर्ण हैं वेटलैंड्स?

एक समृद्ध फूड-वेब समृद्ध जैव-विविधता का परिचायक है और यही कारण है कि इसे बायोलॉजिकल सुपर-मार्केट कहा जाता है। जिस प्रकार से हमारे शरीर में जल को शुद्ध करने का कार्य किडनी द्वारा किया जाता है, ठीक उसी प्रकार वेटलैंड का तंत्र जल-चक्र द्वारा जल को शुद्ध करता है और प्रदूषण अवयवों को निकाल देता है। इसलिए इसको ‘भू-दृश्य के गुर्दे’ भी कहा

जाता है। इतना ही नहीं 'कार्बन अवशोषण' व 'भू-जल स्तर' में वृद्धि जैसी महत्वपूर्ण भूमिकाओं का निर्वहन कर वेटलैंड्स पर्यावरण संरक्षण में अहम् योगदान देते हैं। दुनिया की तमाम बड़ी सभ्यताएँ जलीय स्रोतों के निकट ही बसती आई हैं और आज भी वेटलैंड्स विश्व में भोजन प्रदान करने में महत्वपूर्ण भूमिका निभा रहे हैं। वेटलैंड्स के पास रहने वाले लोगों की जीविका बहुत हद तक प्रत्यक्ष या अपत्यक्ष रूप से इन पर निर्भर होती है। वेटलैंड्स जंतु ही नहीं बल्कि पादपों की दृष्टि से भी एक समृद्ध तंत्र है, जहाँ उपयोगी वनस्पतियाँ एवं औषधीय पौधे भी प्रचुर मात्रा में मिलते हैं। वेटलैंड्स वैसे पारिस्थितिकीय तंत्र हैं जो बाढ़ के दौरान जल के आधिक्य का अवशोषण कर लेते हैं, इस तरह बाढ़ का पानी झीलों एवं तालाबों में एकत्रित हो जाता है, जिससे मानवीय आवास वाले क्षेत्र जलमग्न होने से बच जाते हैं।

जल का द्वंद

एक अध्ययन के अनुसार, यह बताया गया है कि राजस्थान में लड़कियों को पानी लाने के लिए लंबी दूरी तय करनी पड़ती है। यह उनका पूरा दिन खाता है और उन्हें स्कूल जाने के लिए समय नहीं मिलता है। यह पता चला है कि किसानों की आत्महत्या के कुछ मामले सूखे या पानी की कमी के कारण हैं। इससे यह स्पष्ट है कि पानी की कमी भारत और अन्य विकासशील देशों में कुछ सामाजिक समस्याओं का कारण है। 25% शहरी आबादी को पीने के पानी तक पहुंच नहीं है। इसके अलावा, यह भी पाया गया है कि 40 लाख से अधिक लोग पानी से संबंधित बीमारियों के कारण मर रहे हैं।

उपसंहार

जल बचाना जीवन बचाने के बराबर है! ग्रामीण स्तर पर सरकार/ नागरिक प्रबंधन अधिकारियों द्वारा वर्षा जल संचयन शुरू किया जाना चाहिए। वर्षा जल को संग्रहित करने के लिए बड़े या छोटे तालाब खोदे जा सकते हैं। हमारी भूमि फाड़कर पानी निकालने की प्रौद्योगिकी (ट्यूबवेल, समर्सिबल और जेटवेल) नमभूमि क्षेत्रों को सुखा रही हैं; कल को हवा से पानी निकासी की प्रौद्योगिकियाँ वायुमण्डल को सुखाने की दौड़ में लगेंगी। तल, वितल, सुतल में नमी न हो, तो भूमि फट जाये और हम सभी उसमें समा जाएँ। भूमि की ऊपरी परत में नमी न हो, तो चाहे जितने बीज बिखेरें, वे सोये ही रहेंगे; नन्हा अंकुर कभी बाहर नहीं आएगा। हवा में नमी न हो, तो धरती तापघर में तब्दील हो जाये; नन्हा अंकुर दिन-दहाड़े झुलस जाये। चिल्का झील संरक्षण के लिये भारत को 'रामसर अवार्ड' भी दिया गया है, किंतु भारत में लगातार व्यापक

होता भूजल संकट तथा देशी-विदेशी पक्षियों के प्रवास तथा घनत्व में आई कमी गवाह है कि कानूनी कवायद और प्रावधानों के बावजूद हम भारत के अतुलनीय नमभूमि क्षेत्रों की निर्मलता और भूमि का संरक्षण करने में सफल साबित नहीं हुए हैं। आज समझने की जरूरत है कि नमभूमि क्षेत्रों की गुणवत्ता स्थानीय नदी, वनस्पति तथा भूजल भण्डारों पर निर्भर करती है। भारत के ज्यादातर नमभूमि क्षेत्र प्रत्यक्ष-अप्रत्यक्ष रूप से गंगा, ब्रह्मपुत्र, कावेरी, गोदावरी, ताप्ती जैसी नदी प्रणालियों से ही जुड़े हैं। अब यदि नदियाँ ही मैली और सूखी होती जा रही हों, तो इनसे जुड़े नमभूमि क्षेत्रों की सुरक्षा की गारंटी कहाँ बचती है। नमभूमि को बेकार भूमि मानकर उस पर निर्माण करने का लालच हमारा इतना ज्यादा है कि हम उदयपुर, बंगलुरु जैसी मैदानी ही नहीं, नैनीताल जैसी पहाड़ी झील नगरियों में भी झीलों को बसावटों के कब्जे से नहीं बचा पा रहे हैं। नमभूमि, कई उपयोगी देशज पौधों की भी घर होती है। हमारा जीवन भी प्रत्यक्ष-अप्रत्यक्ष रूप से इन सभी से प्रभावित होता है।

नमभूमि के संरक्षण के लिए जागरूकता पैदा करने, उसे बढ़ावा देने तथा इस बारे में सकारात्मक चीजों को बताने के लिए विश्व नमभूमि दिवस हर साल 2 फरवरी को मनाया जाता है। नमभूमि बचाए बगैर न तो वैश्विक तापमान में वृद्धि रोकी जा सकती है और न ही जलवायु परिवर्तन की मार से बचा जा सकता है। अतः अपने स्वार्थ के लिये सही, अब जरूरी हो गया कि यदि बर्बादी से बचना है, तो नमभूमि बचाएँ।

Wetlands and Water

Adarsh Gulvae, SPDC F.Y. B. Sc. CS

Wetlands a clear and widely accepted definition of wetlands has yet to be established. Wetlands are of various types and function and occur in various diverse location and climate which in part make them difficult to define. Many definitions of a wetlands have been posted by different groups and individuals, some of them include “Area of land that is hydric soils and hydrophilic vegetation typically flooded for part of the year and forming a transition zone between aquatic and terrestrial systems.

Wetland is an ecosystem that depends on constant or recurrent shallow inundation or saturation at or near the surface of substrate soil. Wetlands are defined for classification purpose as it was under natural conditions possesses these factors including hydric soil, wetland hydrogeology and hydrophilic vegetation. Hydric soils are soils that are anaerobic for at least one week during growing season. Specific criteria to identify hydric soil are not easy to develop but indicators have been developed by scientist to aid in their definition.

Categories make the management of wetlands more difficult. The public want to protect their wetlands for their valuable functions while private want to use wetlands for their direct economic profit. However, the fact that about 82 % of wetlands are privately owned in US and there is no clear agreement between private owner and public. Wetland protection more complicated and controversy valuing wetland can help visualizing g the benefit of wetlands. However, difficult to implement since value of wetlands are affected by historical event, technological development and social way views.

Protecting and conserving wetlands are the decision made by balancing those two benefits. In case of wetland conservation the private benefits are bigger than public benefit, in contrast if wetlands are protected the public get more benefit than owner.

The Impending doom: Water Crisis and Wetlands

Anand Meherwade

“Man is a part of nature, and his war against nature is inevitably a war against himself.”

Rachel Carson

The lake is parched up. The crops have barely grown and withered from the intense heat. The farmer looks towards the sky, with not a trace of clouds, he feels uncertain about his produce this year. Although drought wasn't unusual, the time of the year was. July is supposed to be rainy season, but with only a few weeks of rain, this is not something a human can overcome. This calamity is occurring all over the places.

One of the biggest threats to survival of humanity is linked to global climate change. The occurrence of major fire outbreaks destroying hectares of forest land killing all the living things in it, to the food resource scarcity where the crops are damaged by the pest attacks or to a once productive land facing recurring drought periods.

Among the most affected countries due to global climate change, India ranks 5th in Climate Risk Index. Above all, with the growing population of the country, India must be ready to combat against the water crisis and its demand. But, the way we are going forward with urbanization is having a disastrous effect on the people and the land. To make space for construction, lakes are covered up. With major cities already facing an acute shortage of water during summer and consecutive years of weak monsoons, urban lakes are the only source of water.

One such city, Bengaluru, which was remarkably known to survive wholly on lakes for agriculture and daily use since centuries, is now facing water shortage. As stated in stone inscriptions found adjacent to lakes, the local communities during the 16th Century made policies that regulated the usage and was managed to conserve the lakes. The ruler and the people gave cultural and religious importance and the lake was considered as a deity for providing an important resource. But, as the city expanded and became a popular hub for IT Sector, the demand for water increased and the value was lost. A city which was once independent in water resource, now had to rely on pipelines to cater the needs. Year by year, the lakes dried up. Various small wetlands were destroyed for the lack of usefulness. Although people and the local authority took measures to protect these lakes from rapid urbanisation, it was too late.

According to a study conducted by CES, IISC Bengaluru, around 98% of lakes have been encroached with over 90% of them affected due to sewage and industrial effluents. These lakes have become a source of diseases. To cover up the mistake, malls and buildings were built and thus, quite a handful of lakes have survived. With data from The Hindu, 2020 was recorded as the hottest year as the Earth's average temperature has risen by 1.2°C. With threats like habitat destruction and effluents discharge, the climate change is going to make the conservation and restoration of wetlands even more complex.

The wetland system will undergo lot of alterations in ecological and biogeochemical aspects. Moreover, the climate change can bring unknown variables to climatic scenarios where the growth of exotic species will be increased making the lakes unusable. While this calamity might seem local to cities only and urban area limited, this has a butterfly effect on Western Ghats and on pristine forests located hundreds of miles away. The hydro projects to divert the rivers will cause large scale deforestation and decreased water table to the local population of Western Ghats. With Bengaluru as one such case, numerous cities all over India are struggling to get access of clean water.

As the thirst for water to meet the growing demands to rapid urbanization is unquenchable and if the wetlands aren't allowed to be rejuvenated, this along with the climate change will make the city unsuitable to survive. Various working sectors of the city will be forced to move out from the city to pursue employment.

With WWF Water Risk Filter, an online tool that assesses the water risk worldwide, and by the report, 30 cities in India will face the severe risk of water scarcity by 2050. As IT sector will continue to attract business and investors from all around the world, there is an immediate need to tackle the issue of water demand. Although there are numerous wetland protection laws and acts to prevent the damage, there is an absolute need to implement proper guidelines and management to protect the wetlands. While some political leaders might say the climate change is not real even with all the consolidated statistic data on the phenomenon, the occurrences do not.

As the world prepares to address the global issues, we must not forget, without the Earth and its resources, no matter how we look at it, if humans continue turning a blind eye, the future will be brimmed with grave danger. The question is not will, but when.

Climate change, Water crisis and Wetland

Gauri Singh, SPDC

Introduction: - Climate Change is the defining issue of our time and we are at a defining moment. From shifting weather patterns that threaten food to rising sea levels that increase the risk of catastrophic flooding. The impacts of climate change are global in scope and unprecedented in scale. Without drastic action today, adapting to these impacts in the future will be more difficult and costly. The main climate change consequences related to water resources are increases in temperature, shifts in precipitation patterns and snow cover, and a likely increase in the frequency of flooding and droughts. Climate change can disrupt food availability, reduce access to food, and for example, projected affect food quality. Increases in temperatures, changes in precipitation patterns, changes in extreme weather events, and reductions in water availability may all result in reduced agricultural productivity. Climate change can disrupt food availability, reduce access to food, and affect food quality. For example, projected increases in temperatures, changes in precipitation patterns, changes in extreme weather events, and reductions in water availability may all result in reduced agricultural productivity.

In the early 1970s, the main obstacle confronting wetland restoration efforts was developing the science for successful wetland restoration projects. Although we have made much progress on that front, the issue of climate change may present greater challenges to wetland conservation and paper originally produced restoration. This is a policy at the request of the scientific and technical review panel of the Ramsar Convention on Wetlands. And in corporate opinion, interpretation and scientific-based arguments. Ramsar convention is the the Global intergovernmentalWater crisis in India.....Treaty which addresses the Conservation and wise uses.

Wetlands and climate change:- Increased heat, drought and insect outbreaks, all linked to climate change, have increased wildfires. Declining water supplies, reduced agricultural yields, health impacts in cities due to heat, and flooding and erosion in coastal areas are additional concerns. Wetlands and climate change wetlands emit 20 to 25 % of global methane emissions to earth's atmosphere, yet they also have the best capacity of any ecosystem to retain carbon through permanent burial (Sequestra-Tion). Both processes have implications for climate change. Of the total storage of organic carbon in earth's soils, 20 to 30 % or more is stored in wetlands, and that storage is vulnerable to loss back to the atmosphere if the climate warms or becomes drier. This Book excerpt discusses the significant, yet underappreciated role of wetlands in the global carbon cycle. India's water crisis is often attributed to lack of Government planning, increased corporate privatization, industrial and human waste and government corruption. In addition, water scarcity in India is expected to worsen as the overall population is expected to increase to 1.6 billion by year 2050. Some of the solutions which could be effective in dealing with the water crisis are listed below: Rain water harvesting.

India receives enough rain water annually during monsoon. So rain water harvesting should be encouraged in large scale, particularly, in cities where surface run off of rain water is very high. The effects of climate change Theses are the side effects of Climate change like rising maximum temperatures, rising minimum temperatures, rising sea levels, higher ocean temperatures. An increase in heavy precipitation (Heavy rain and Hail) shrinking glaciers. Heat pollution is not a Solution. Future generations will blame us for global warming. One good action in a day to combat the heat. Stop making the planet vulnerable by heating it. "Climate change is the single greatest threat to a Sustainable future but, at the same time, addressing the climate challenge presents a Golden opportunity to promote prosperity, security and a brighter future for all. Just hope for the best for all....

Climate Change, Water Crisis and Wetlands

Mamta Sahani, SPDC

A wetland is a distinct ecosystem that is flooded by water, either permanently or seasonally, where oxygen free processes prevail. The primary factor that distinguishes wetlands from other land forms or water bodies is the characteristics vegetation of aquatic plants, adapted to the unique hydric soil.

Wetlands play a number of functions including water purification of water storage processing of carbon and support of plants and animals. Wetlands are also considered the most biologically diverse of all ecosystems serving as home to wide range of plant and animal life. Whether any individual wetland performs these functions and the degree of which it performs them depend on characteristics of wetland and lands and water near it. Methods of rapidly assessing these functions, wetland ecological health and general wetland condition have been developed in many regions and have contribute to wetland conservation partly by raising public awareness of the functions and the ecosystems services some wetlands provide.

Wetlands perform two important functions related to climate change. They have mitigation effects through their ability to sin carbon, converting a greenhouse gas (Carbon dioxide) to solid plant material through the process of photosynthesis and also through their ability to store approximately 44.6 million tones of carbon per year globally. In salt marshes, marshes and mangroves swamps particular the average carbon sequestration rate is $210 \text{ g CO}_2 \text{ m}^{-2} \text{ y}^{-1}$ while peatlands sequester approximately $20\text{-}30 \text{ g CO}_2 \text{ m}^{-2} \text{ y}^{-1}$.

Coastal wetlands, such as tropical mangroves and some temperate salt marshes are known as to be sinks for carbon that otherwise contribute to climate change in its gaseous forms (carbon dioxide and methane).

Depending on the characteristics some wetlands are significant source of methane emissions and some are also emitters of nitrous oxide which is greenhouse gas with a global warming potential 300 times that a carbon dioxide and is the dominant ozone- depleting substance emitted in the 21st century. Excess nutrients the mainly from anthropogenic sources have been shows to significantly increase the NO_2 , from wetlands soils through denitrification and nitrification process. A study in the intertidal regions of New England salt marshes showed that excess of levels of nutrients might increase NO_2 emissions rather than sequester them.

Nowadays we are facing the crisis of water. The increase in demand due to population growth, the infrequent rainfall is aggravating the situation day by day insufficient number of reservoirs is also one of the causes of water crisis perpetual silting of water reservoirs, lakes, canals, rivers and waterways to one of the major reasons of shrinking water storage capacity.

Mismanagement of water and the growing population in our country are the two main reasons for water scarcity; these are also a number of the manmade disturbances that continue to rise. Besides this some of the reasons for water scarcity are wasteful use of water for agriculture, reduction in water recharges systems, lack of water management and distribution and replace dripping taps.

In India an agricultural country, produces a huge quantity of food to feed to its population. The surplus that is left gets exported outside, it is not unknown that producing this much food requires a lot of water too. The traitor

method of irrigation wastes a lot of water due to evaporation water conveyance drainage, percolation and the overuse of groundwater.

There is a need for an efficient system to manage and distribute the water in urban areas. The Indian government also needs to enhance its technology and investment in water treatment. In India it is commonly seen as most of the houses have taps or faucets that go on dripping water even when they are closed. This running tap water up to 30000 liters of water that nobody bothers to change so we should replace these taps immediately.

To conclude, water scarcity has become an alarming issue day by day. If we do not take the problems of water scarcity seriously now, our future generations are going to suffer severely and may even have to buy this necessity at a high level.

Economics for Sustainable Development and Conservation of Wetland

Name : Mansi Rajan More, Std: F.Y.B.COM

Email : moremansi2002@gmail.com, Contact: 8928332711

Sustainable development is an approach to economic planning that attempt to foster economic growth while preserving the quality of environment for future generations. Economic growth occurs when real output increase over time. Real output is measured by Gross Domestic Product (GDP) at constant prices so that the effect of price rises on value of national output is removed. The sustainable development aims at creating sustainable improvement in quality of life all people. It is process whereby the development can be sustained for generation. It affords future generation the same, if not more capacity to prosper as present generation. Economic

From the late 1980's sustainable development means the fostering of economic growth while preserving the quality of environment for future generation became a leading concept in environmental policy making with nature resources considered as economic drivers, environmental policy making was no longer the exclusive domain of government. Economic development is not blessing for human being. No doubt, it brings higher material welfare by increasing national output of goods and services on one hand and on other hand it pollutes the environment badly by overuse or misuse of natural resources. The after effects of environmental damage have already been appearing in form of green house effects, global warming, acid rain ect. Now the basic question is how economic development and congenial environment can co-exist so that development can be sustainable for generation. That is why 'Sustainable Development' has came into discussion.

Wetland are areas where water covers the soil or is present either at or near surface of soil all year or for varying periods of time during the year, including during the growing season wetland may support both aquatic and terrestrial species. Wetland is vital for human survival. Wetland are indispensable for the countless benefits or ecosystem service that they provide humanity ranging from freshwater supply, food and building , material and biodiversity to food control groundwater recharge and climate change mitigation. Wetland exists in many kinds of climate on every continent except Antarctica. They vary in size from isolated prairie potholes to huge salt marshes. They are found along coasts and inland some wetland is flooded woodlands full of trees. A wetland is a place where the land is covered by water either salt, fresh water or somewhere in between. The destruction of wetlands is a concern because they are some of most productive habitats on planet.

Wetland are indispensable for countless benefits or ecosystem services that they provide humanity ranging from freshwater supply food and building material recharge and climate change mitigation. Wetland conservation is aimed at protecting and preserving areas where water exists at or near the earth's surface such as swamps marshes and bogs. Wetland covers at least six per cent of the earth and has become a focal issue for conservation due to ecosystem services they provide.

Economics of Sustainable Development and Conservation of Wetland

Name: Meenakshi Ashok Patil

Class: T Y B Sc

College: Satish Pradhan Dnyanasadhanacollege, Thane

Wetland ecosystem are among the most threatened of all environmental resources .Wetlands ecosystem accounts for about 6% of global land area.

If conservation of natural resources goes wrong, nothing else will go right

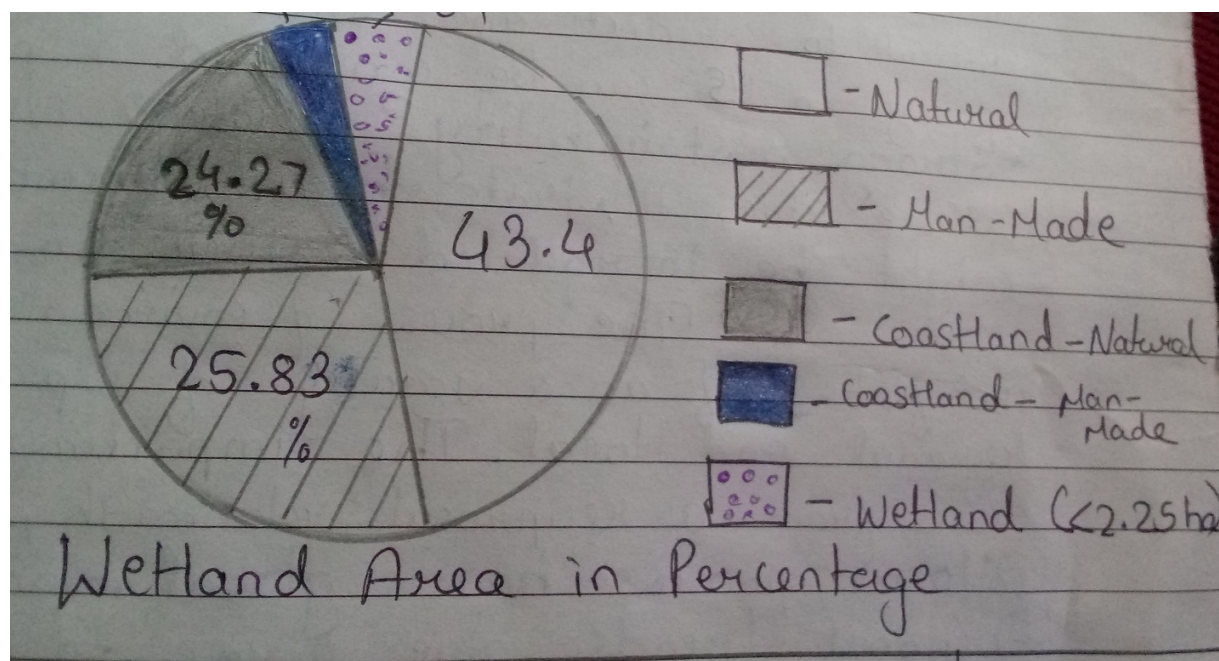
Under the sustainability principle there is a requirement for the sustainable management of environmental resources, whether in their pristine state or through sympathetic utilization, to ensure that current activities do not impose an excessive cost and loss of options burden on future generations. It has been suggested that it is large scale complex functioning ecological that ought to form part of functional system they are therefore likely to be most beneficial of conserved as integrated ecosystem rather Than in terms of their individual component parts. Sustainability implies a wider and more explicitly long term context and goal than environmental quality enhancement

Strong sustainability can be interpreted as requiring that natural resourced be considered as essential inputs in economic production, consumption or welfare or as acknowledge environmental integrity intrinsic value and rights in nature .Very strong sustainability would imply that every components or Subsystem of natural and environmental assets that are critical in sense of providing ,in principle, be preserved. Environmental Sustainability depends mainly on ecosystem stability, resistance and biodiversity. Traditional welfare economics focuses more on static environment equilibrium than on fluctuation and cycles.As a result, it is unable to deal with sustainability and uncertainty in way consistent with ecological theory

“Make a splash, take time to reflect listen to nature read more be green don’t get bogged down what’s the rush”

Current state of wetland in India

In India, numerous acts and legal provision have been applied to conserve the fragile wetland ecosystem and as a result of which the Ministry of Environment, Forest and Climate change, Government of India has declared 17 sites as notified wetlands, while 26 have already been declared as wetlands of international importance under Ramsar conservation



Particulars	Status (total no)
Total no of wetland in country as per latest National wetland atlas	55862
Number of natural wetlands under conservation	
A) Wetland designed as Tamar site understand NWP	119
B) Wetland under NLCP	61
C) Wetland under NRCP	39
D) Overall no of wetland under conservation	219

Wetland conservation

Ramsar convention is a major step at the global level for conservation of the wetland ,which forms an agenda of intergovernment collaboration on wetland .It is an international treaty taken up with moral duty of conservation and sensible use of all wetlands by local, national and international co-orporation towards achieving sustainable development. Dyana (2015) reported that the situation for the conservation of wetland in India is poor due to lack of any administrative Jurisdiction care and responsibility. However, the conservation of wetland in India is indirectly influenced by a range of polices and legislation (parik and parik 1999).Some of the important regulation that contribute to wetland conservation

“Times to care Before

Streams are Bare”

विषय : पाणी संकट आणि जल संवर्धन
कु. नताशा रायसिंग, सतीश प्रधान ज्ञानसाधना महाविद्यालय, ठाणे

आता उरले आहे कुठे पाणी
ज्यांच्याकडे आहे त्यांना किंमत नाही
ज्यांच्याकडे नाही ते फिरतात घोटभर अनवाणी
शहरात अंधोळीसाठी दोन दोन तास वाया घालवतात पाणी..

काय? काही लक्षात येत आहे की नाही , आपल्या शहरामध्ये नको तितके पाणी वाया घालवतात सगळे , परंतु एकहीजण असा विचार करत नाही की ज्या गावांमध्ये पाणी नसेल तर त्यांची अवस्था काय होत असेल? केलाय का कधी असा विचार नाही ना कारण शहराकडे फक्त स्वतःपुरता विचार करण्यासाठी सुद्धा वेळ नाही तर मग दुसऱ्यांचा विचारच कसा करणार बरोबर ना? पाण्याला जीवन असे म्हंटले जाते. आज अनेक नित्योपयोगी गोष्टीसाठी पाणी लागते. पाण्याची आवश्यकता अशी सर्वच क्षेत्रात जाणवत असताना आपण पाण्याचा गैरवापर करतोय हे चुकीचं आहे. जगातील सांडपाण्याचे प्रमाण वाढत आहे, मात्र भूजलाची पातळी खाली जात आहे. कोलंबसने जहाजावर अनेक दिवस सतत प्रवास करीत असताना म्हंटले आहे की, “सगळीकडे पाणीच पाणी आहे , पण पिण्यासाठी एक थेंबही पाणी नाही”. ह्याला ही जबाबदार कोण? आपणच ना, पिण्याच्या पाण्याचे नियोजन हा आपल्यासाठी खर तर अगदी जिवाळ्याचा विषय असायला हवा. पण शहरांमध्ये तर तस काहीच दिसत नाही, कल भरून ठेवलेले पाणी बिनदिक्कतपणे ओतून दिले जाते. भांड्यातील तळाशी गेलेलं पाणी वर आणण्यासाठी कावळ्याने त्यात जे दगड ती गोष्ट आठवा ! स्वयंपाकघरातील व आंधोळीचे वापरलेलं पाणी शौचालयाच्या टाकीत कसे वापरले जाईल या दृष्टीने प्रयत्न व्हावयास हवे आहेत. आज आपल्या देशात जवळजवळ प्रत्येक शहरात पिण्याचे व अनेक ठिकाणी वापरण्याचे पाणी नळाने पुरविले जात आहे. अनेक ठिकाणी हे पाणी पुरत नाही म्हणून नालिकाकूप विहिरी किवा काही ठिकाणी अजून शाबूत असलेल्या जुन्या विहिरीचे पाणी वापरले जाते, अनेक शहरांमधून पाण्याचा इतका तुटवडा जाणवतो की , तेथे पाणी मोठमोठ्या जलटोक्यांमधून पुरवले जाते. पण या पाण्याच्या टाक्या कधी धुतल्या जातात का, याची फारशी कोणी दाखल घेताना दिसत नाही. टाक्या धुतल्या गेल्या नाहीत तर टाकीच्या आतल्या भागावर बऱ्याच वेळा क्षारांची पुटे चढू लागतात आणि आपल्याला क्षारयुक्त पाणी प्यावे लागते म्हणून पाण्याचा टाक्या धुण्याचे वार्षिक वेळापत्रक करून ते प्रत्येक संस्थेत पाळले पाहिजे. आज इतर प्रत्येक खेड्याच्या तुलनेमध्ये ‘राळेगण सिद्धी’ हे आदर्श खेडे मानले जाते. इथे आज मोठ्या प्रमाणात झाडे लावली गेली आहेत व टेकड्यांवर विशिष्ट प्रकारे बांधबंदिस्ती करून वाहून जाणाऱ्या पाण्यामुळे होणारी जमिनीची धूप थांबवली गेली आहे. पावसाचे हे पाणी साठवून वापरण्यासाठी इथे मोठे बांधीव कालवे तय्यार केले आहे. ह्यामुळे ह्या भागातील भूजल पातळी लक्षणीयरीत्या उंचावली असून कोरडी पडलेली विहीर अथवा कूपनलिका दिसत नाही. तसेच उत्तर व पूर्व भागातील वारंवार पुर येणाऱ्या अनाज बारमाही नद्यांचे पाणी पश्चिम आणि दक्षिण भारतातील दरवर्षी कोरड्या पडणाऱ्या नद्यांच्या जलाशयात आणून सोडणे म्हणजे नदी जोड प्रकल्प. दुष्काळग्रस्त भागात पडणाऱ्या पावसाच्या प्रत्येक थेंबाचा वापर करून भूजल पातळीत वाढ करणे शक्य आहे हे आपल्या देशात अनेकांनी वेगवेगळ्या छोट्या प्रकल्पांमधून दाखवून दिले आहे. पण अजूनही हाच प्रश्न पडतो की खरच दुष्काळग्रस्त गावामध्ये अजूनही पाणी संकट आहे का? उन्हाळ्यात खूप जास्त प्रमाणात ऊन पडल्याने गावातील शेकडो घड दुष्काळात जातात गावाला पाणी नाही, तसचं दुष्काळ पडल्यामुळे गावातील नदी, विहीर, ओहोळ सगळे आटून जातात आणि जून आणि जुलै चालू झाले तरीही गावातील दुष्काळ काही जात नाही ह्या सगळ्यांना आणि दुष्काळाला जबाबदार कोण? माणूस.....कारण शहरीकरण, औद्योगिकीकरण , लोकसंख्यावाढ , विकास अशा अनेक कारणांमुळे वृक्षतोड होत आहे त्यामुळे भूजल पातळी कमी

होत आहे पाण्याचा अतिरिक्त वापर होतोय.काही भागात ओला दुष्काळ तर काही भागात सुका अशा प्रकारे पाण्याचे संकट निर्माण होत आहे.आज शहराकडे असणाऱ्या लोकांना ह्याच काहीच वाटत नाही कारण प्रत्येकाच्या घरांमध्ये पाणी येत तेही दररोज. पण कधी त्या गावकऱ्यांचा विचार केलाय का की ते कसं ह्या पाणी संकटातील दुष्काळाला सामोरे जात असतील. फक्त एकदा नक्की विचार करून बघा नक्की तुमच्या डोळ्यात पाणी येईल.....

THANE CREEK

NAME :- NEELIMA SINGH DILBAHADUR , SPDC

YEAR:- S.Y.B.B.I.

ROLL NO. :- 75

Thane creek is an inlet in the shoreline of the Arabian Sea that isolates the city of Mumbai from the Indian mainland. It comprises the area between Mumbra and Retibunder and the Mankhurd -Vashi Bridge. The creek is divided into two parts. The first part lies between Ghodbunder and Thane, a section from where the Ulhas river flow from the north of Mumbai island to meet the Arabian sea on the west. The part of the waterway lies between the city Thane and the Arabian sea at Trombay/ Urban, before the Gharapuri island. Thane creek was formed due to seismic fault lying below it which runs from Urban to Thane.

Thane creek is one of the biggest natural creeks in India but also the most polluted one. High level of phenolic compounds, detergents, alcohol either and acetone have been found in thane creek.

These was revealed by a survey conducted by institute of science, Mumbai, which stated the fourth generation pollution is responsible for destruction of vegetation and marine life in the thane creek.

“Marine life in the creek is reeling under a variety of stresses. Dangerous level of heavy metal pollution, rampant tree felling for fuel during low tide and exploitation of existing fish and crab resources have caused severe damage to the eco-system,” said Prof. Sunil Naik of Indian institute of technology (IIT) Bombay.

Thane creek flamingo sanctuary:-

The Maharashtra government has declared the area along the western bank of the Thane Creek as the “Thane Creek Flamingo Sanctuary. It will be a 2nd marine sanctuary after Malvan sanctuary. During the Covid -19 pandemic worldwide lockdown was seen as a result the pollution levels were drastically reduced and so as a result in the mid of December 2020.

Thane Road Bridge:-

Thane road bridges are the oldest bridge built over this creek. This bridge connects Thane and Kalwa. The old road bridge is no longer in use and has been superseded by the new parallel bridge. Vashi road bridge connects two sister cities of Mumbai and Navi Mumbai. This bridge is very important bridge as it carries heavy traffic between Mumbai and Pune. Being one of the busiest routes in India, the bridge provide the shortest route to Pune.

Railway bridges:-

Thane railway bridge or Thane railway viaduct is the oldest rail bridge constructed on this creek. The bridge lies between thane and Parsik tunnel, kalwa. It has two sections, a smaller section built of stones and concrete and a longer section built of stone and concrete but with a steel girder in middle. A parallel railway bridge lies on the harbor line of Mumbai suburban railway. A new parallel railway bridge, also with two sections, has been

constructed for fast local trains. The railway bridge is shown on Google Maps as Mankurd Vashi Railway Bridge.

The edges of the creek on the Mumbai coast were used on salt-pan land of almost 300 years. The legal tenureship ownership and the rights to those lands have been a complicated issue is now due to legally overridden by the government (state of central) for development purposes. The known are coverage of such salt-pan lands amount to almost 2200 hectares in Mumbai. The salt panning does not yield good quantity and quality of salt now, due to siltation, reclamation and pollution of the Thane creek in reality through, most of these lands have been brought up over time by developers, so they might come under private ownership which means the developers can build on the land as desired.

ECONOMICS OF SUSTAINABLE DEVELOPMENT AND CONSERVATION OF WETLANDS

Pooja Yadav

Economics and sustainable development.

Under the sustainability principle there is a requirement for the sustainable management of environmental resources, whether in their pristine state sympathetic utilization to ensure that current activities do not impose an excessive cost and loss of options burden on future generations. It has been suggested that it is large scale complex functioning ecologies that ought to form part of the intergenerational transfer of resources. Strong sustainability can be interpreted as requiring that natural resources be considered as essential inputs in economics production, consumption or welfare or as acknowledging environmental integrity intrinsic value and right in nature. Especially when environmental components are unique or environmental processes are irreversible the latter issues may become are irreversible the latter issues may become important.

Total economic and ecosystem value:

In instrumentally valuing a resource such as a wetland. The total economic value can be broken down into a number of categories.

Another categories is that of option value, in which an individual derives benefits from ensuring that a resource will be available for use in the future. In this sense it is a form of use value, although it can be regarded as a form of insurance to provide. For possible future but not current use. An example of an option value is in bio prospecting.

When biodiversity may be maintained on the off chance that it might the future is the sources of important new medicinal drugs. It has been suggested that option value less a distinct category of total value than the difference between an ex ante perspective yielding option price and an ex post ante perspective giving expected consumer surplus, as a measure of value. Option value is associated with the potential benefits of awaiting improved information before giving up the option to presence a resources for future use. It suggests a value in particular of avoiding irreversible damage that might prove to have been unwarranted in the light of further information.

Conservation of wetland:

The convention on wetland of international important also known as the Ramsar convention, defines wetlands as including lakes and rivers, swamps and marshes, wet grasslands and pea lands oases estuaries deltas and tidal flats, near shore marine areas mangroves and coral reefs and human made sites such as fish ponds rice paddies, reservoirs, and salt pans.

Wetland function

The main functions performed by wetlands are water filtration, water storage, biological productivity, and provide habitat for wildlife. Additional functions and uses of wetland are described in wetlands

1) Filtration: Wetlands and in water filtrations by removing excess nutrients, slowing the water allowing particulates to settle out of the water which can then be absorbed in to plant roots studies have shown that up to 92% of phosphorous and 95% of nitrogen can be removed from passing water through a wetland. Wetland also let pollutants settle and sticks to soil particles, up to 70% of sediments in run off some wet lands plants have even been found with accumulations of heavy metals more than 10,000 times that of the surrounding water's concentration. An example of such a situation is the Mississippi River's dead zone, an area where nutrient excess has led to large amounts of surface algae, which use up the oxygen and create hypoxic.

2) Storage: wetlands can store approximately 1-1.5 million gallons of flood water per acre. When you combined with the approximate total acres of wetland in the united states (107.7million acres) mean that us wetlands can likely store over a trillion gallons of floodwater.

By storing and slowing water, wetlands allow ground water to be recharged. A 550,000acre swamp in Florida has been value at \$25 million per year for its role in storing water and recharging the aquifer. 3) Biological productivity: Through wetlands ability to absorb nutrients, they are able to be highly biological productive. Freshwater wetlands are even comparable to tropical rainforests in plant productivity. Their ability to efficiently create biomass may become important to the development of alternative energy sources. While wetlands only cover around 5% of the conservation united states land surface they support 31% of the plants species.

4) Wild life habitat: wildlife habitat is important not only for the conservation of species but also for a conservation purpose, wildlife habitat is managed for maintain and using the resources in sustainable manner. 95% of all commercially harvested fish and selfish in the united states are wetland dependent.

Conservation by country: The following list:

- a) New Zealand
- b) Republic of Macedonia c) South Africa
- d) Sweden
- e) U.S

A) New Zealand

Wetland of New Zealand over 90% of the wetland in

New Zealand have been drained since European settlement, predominantly to create farmland wetlands now have a degree of protection under the Resource Management Act 1991.

B) Republic of Macedonia: The fragments of wetlands habitats that are still in existence in the Republic of Macedonia are present as marsh or swamp communities.

C) South Africa: The south African department of environment affairs in conjunction with the department of water. Affairs in conjunction with the department of water affairs and forestry and agriculture support the conservation and rehabilitations of wet lands through the working for wetlands programs.

Sweden: The Swedish national wetland inventory is one of the world's most extensive systematic inventories of nature types that have even been done. VIM has surveyed the wetlands of Sweden below the alpine region during a 25year period.

In total 35000 objects are included in VMI, corresponding to an area of 4.3 million hectares, or 10% of the land are a Sweden.

D)U.S: The us wetland conservation efforts are rooted partly in

Legislative requirements specifying that when proposal is made to drain a wetland, the proposers in many cases must offset the loss by restoring or constructing wetland nearby that are of the same or greater size and levels.

Conclusion: An important aspect of the economics science interface in the possible existence of thresholds and the potentials for irreversible change.

हवामान बदल, पाणी संकट आणि आर्द्रता

प्राची पाठक

पर्यावरणातील प्रत्येक बदल प्रमाणे महत्वाचे असलेले बरेच बदल आहेत. त्यातील हवामानबदल महत्वाचा घटक मानला जातो. महासागराचे प्रवाह उष्ण कटिबंधीय प्रदेशांमधून थंड ध्रुवीय प्रदेशात बरीच ऊर्जा वाहतूक करतात. शेवटच्या बर्फ युगाच्या आसपास होणारे बदल तांत्रिक भाषेत सांगायचे झाले तर शेवटची हिमनदी हे दाखवते कि उत्तर अटलांटिक या भागात अचानक आणि मोठ्या प्रमाणात बदल होण्याची शक्यता असते.

जेव्हा हवामानातील बदल घडतात तेव्हा पृथ्वीच्या प्रणालीतील बदलामुळे नवीन हवामानपद्धतीचा परिणाम होत असतो. भूशास्त्रातील पुरावे असे सांगतात कि भूतकाळातील तापमानाचे स्वरूप सध्याच्या तापमानाच्या स्वरूपापेक्षा निराळ होत. काही ठिकाणी अतिशय जास्त तापमान तर काही ठिकाणी अतिशय कमी तापमान असायचे. परंतु सध्या जी तापमानवाढ होत आहे ती प्रचंड जलदगतीने होत असल्याचे दिसत आहे. नैसर्गिक घटकांमुळे होणाऱ्या तापमानवाढी प्रमाण हे मानव निर्मित घटकातून होणाऱ्या तापमानवाढीपेक्षा जास्त झाले आहे. म्हणजेच निसर्ग बेभरवशाचा झाला आहे. याचे गंभीर परिणाम आपल्याला भोगावे लागतील असे दिसून येते. यातील मोठा परिणाम म्हणजे पाण्याचे संकट पाण्याचे संकट वाढल्यामुळे महाराष्ट्रातील विदर्भ, मराठवाडासारख्या भागांना दुष्काळाशी देखील सामना करावा लागतो. शेतकऱ्यांना शेतीसाठी पुरेसे पाणी मिळत नसल्याने पुरेसे पीक येत नाही. कधी कधी तर याकारणाने सुपीक जमीन नापीक होऊन जाते. याकारणाने या भागात शेतकऱ्यांनी आत्महत्या केल्याची बातमी कितीतरी आपण वाचतो. काही लोक असे म्हणतात कि जागतिक तापमानवाढ किंवा हवामानबदल असे काहीही नसते. म्हणून मनातील संशय घालवण्यासाठी विविध संशोधकांनी हा गैरसमज घालवण्याचा प्रयत्न केला. गेल्या शतकात पृथ्वीचे सरासरी तापमान 0.4° ने वाढले आहे. आणि धक्कादायक बाब म्हणजे गेल्या ३ दशकात 0.6° ने तापमान वाढले आहे. तसेच अलीकडील दशकात सागरीपातळीत ३मिमीची वाढ झाली आहे. उष्णतेमुळे पाण्याचे प्रसरण होत त्यातून ही पातळी वाढल्याचे दिसून येते. पृथ्वीवरील सर्व जीवांना जिवंत राहण्यासाठी शरीरातील पाण्याचे प्रमाण सदासर्वकाळ योग्य व पुरेसे ठेवावे लागते. शरीरातील पाण्याचे प्रमाण १० टक्क्याहून कमी झाले तर सजीव जिवंत राहू शकत नाही. मानवीशरीर अन्नाशिवाय काही आठवडे जिवंत राहू शकते पण पाण्याशिवाय सात दिवसांपेक्षा जास्त दिवस जगूच शकत नाही.

विकासाच्या नावाखाली गेल्या काही दशकांमध्ये जी वृक्षतोड झाली, पर्यावरणाची हानी झाली, सिमेंटची जंगले उभी राहिली. वाहनांच्या संख्येत मोठ्या प्रमाणात वाढ झाल्यामुळे प्रदूषणाचे प्रमाण वाढते. या सर्व गोष्टींचा परिणाम म्हणून जागतिक हवामानात बदल होत असून, कार्बन उत्सर्जनामुळे हे प्रमाण दिवसेंदिवस वाढतच आहे. हवामानबदलांचा विचार करायचा झाल्यास ज्या प्रमाणे प्रत्येक देशाची आर्थिक, सामाजिक परिस्थिती वेगळी त्याच प्रमाणे भौगोलिक परिस्थिती ही वेगळी आहे. इथून तिथून मानवजात सगळीकडे एक आहे आणि म्हणून काही संकटे ही देशापुरती, काही त्या देशातील प्रांतापुरती, परंतु जगावरील संकट असे ज्याचे स्वरूप मांडता येईल, अशा जागतिक हवामानात जी वेगाने बदल होत आहे ती जगापुढची आज ची

सगळ्यात मोठी चिंता आहे. शहरात उभी राहणारी सिमेंटची जंगलेही अपरिहार्य आहेत. कारण शहरातील वाढत्या लोकसंख्येचा लोंढा जगातील कोणत्याही शहरात रोजगार आहे म्हणून आहे. एक मुंबईचे उदाहरण घ्या. इथे रोजगार नसता तर कोणी फिरकले नसते. गाव सोडून शहरात गर्दी करावी, असे कोणालाही वाटत नाही. तेव्हा जागतिक परिभाषेत जे नागरीकरण मेट्रोसिटी मध्ये रूपांतरित झाली आहेत त्यांचे प्रश्न वेगळेच आहेत. ओस पडत चाललेली खेडी हा आपल्या देशातील आणखी एक वेगळा प्रश्न आहे. महाराष्ट्र आणि देशापुरते बोलायचे तर जमिनीतील वाढत चाललेला पाण्याचा उपसा हेही वाढत्या तापमानाला कारणीभूत ठरत आहे. असे अनेक प्रश्न एकमेकांत गुंतलेले आहेत. पॅरिसमधील जागतिक परिषदेनंतर त्या त्या देशातील लोक आपापल्या देशात परत गेल्यानंतर त्यांना स्थानिक परिस्थितीनुसार, काही वेगळे प्रश्न समोर मांडून त्याची उतरे शोधावी लागतील. पण, जगाच्या संकटाच्या वेळी सगळे जग एक झाले, ही सुध्दा खूप मोठी समाधानाची गोष्ट आहे. या सर्व गोष्टीची खूप मोठी किंमत आपल्याला मोजावी लागेल. तसेच सध्या कोरोना (कोविड 19) चा प्रचंड प्रमाणात प्रसार झाला आहे. त्यामुळे भारतच नाही तर संपूर्ण जग घाबरून गेले आहे. यामुळे माध्यमावर्गीय गटाचे प्रचंड नुकसान झाले आहे. हातावर पोट असेलेले तसेच रोजगारावर घर चालणाऱ्या लोकांचे प्रचंड नुकसान झाले आहे. शिक्षणावर देखील याचा परिणाम झाला आहे. परंतु या सगळ्यामागे एक मात्र अत्यंत चांगले काम झाले आहे ते म्हणजे पर्यावरण. कोरोना आधी झालेल्या प्रदूषणामुळे तब्येती बिघडत होत्या. परंतु बराच काळ सर्व बंद असल्याकारणाने वाहनामुळे होणारे प्रदूषण कमी झाले. पाण्याच्या सर्व स्रोत मधील प्रचंड कचरा कमी झाला. आकाश पुन्हा खुले दिसू लागले. म्हणतात ना वाईटातून काही चांगले घडते ते असे.

अर्थात पर्यावरणाचे रक्षण केले पाहिजे जर चांगली जीवन शैली आणि चांगले आरोग्य पाहिजे असेल तर. झाडे लावा, पाणी वाचवा. सध्या माणूस घड्याळाच्या काट्यावर चालत आहे. परंतु यातून देखील वेळ काढून पर्यावरणासाठी प्रत्येक व्यक्तीने काही ना काही तरी केले पाहिजे. तरच आपण आपल्या पृथ्वीला आपल्या पर्यावरणाला वाचवू शकतो. चला तर मग आपण स्वतःच्या मनाशी निश्चय करूया आणि पर्यावरणाचे जतन करूया.

Climate change, water crisis and wetlands

Priyanka Matkar, SPDC

Global climate change is recognized as a threat to species survival and the health of natural systems. Scientists worldwide are looking at the ecological and hydrological impacts resulting from climate change. Climate change will make future efforts to resort and manage wetlands more complex. Wetland systems are vulnerable to changes in quantity and quality of their water supply, and it is expected that climate change will have a pronounced effect on wetlands through alterations in hydrological regimes with great global variability. Wetland habitat responses to climate change and the implications for restoration will be realized differently on a regional and mega watershed level, making it important to recognize that specific restoration and management plans will require examination by habitat. Floodplains, mangroves, sea grasses, salt marshes, Arctic wetlands, peatlands, freshwater marshes and forests are very diverse habitats, with different stressors and hence different management and Restoration techniques are needed. The Sundarban (Bangladesh and India), Mekong river delta (Vietnam) and Southern Ontario (Canada) are examples of major wetland complexes where the effects of climate change are evolving in different ways. This successful long-term restoration and management of these systems will hinge on how we choose to respond to the effects of climate change.

Climate change is recognized as a major threat to the survival of species and integrity of ecosystems worldwide (Hulme 2005). The body of literature on the ecological and hydrological impacts expects to result from climate change has grown considerably over the past decade. Pressures on wetlands are likely to be mediated through changes in hydrology, direct and indirect effects of changes in temperatures, as well as land use change (Ferrari et al. 2005). Examples of impacts resulting from projected changes in extreme climate events (Ramsar (STRP) 2002) include: change in base flows; altered hydrology (death and hydro period); increased heat stress in wildlife; extended range and activity of some pest and disease vectors; increased flooding, landslide, avalanche and mudslide damage; increase soil erosion; increased flood run off resulting in a decrease in recharge of some floodplain aquifers; decrease water resource quantity and quality; increased risk of fires, increased coastal erosion and damage to coastal buildings and infrastructures, increased damage to coastal ecosystems such as coral reefs and mangroves and increased tropical cyclone activity. Under currently predicted future climate scenarios, the spread of exotics will probably be enhanced, which could increase pressure on watersheds and ecosystems.

Wetlands mitigate the impacts of floods by absorbing excess water and retaining it or returning it to the water table as a precious resource during times of scarcity. A river with high embankments is cut off from its floodplain and associated wetlands.

Water scarcity (water stress for water crisis) is the lack of freshwater resources to meet

the standard water demand. Humanity is facing a water crisis due to an unequal distribution (open exacerbated by climate change) resulting in some very wet and some very dry geographic locations plus a sharp rise in global freshwater demand in recent decades driven by industry. Water scarcity can also be caused by droughts, lack of rainfall for pollution. This was listed in 2019 by the world economic forum as one of the largest global risks in terms of demand, economic competition for water quantity and quality disputes between users, irreversible depletion of groundwater and negative impact on the environment. Two-thirds of the global population (4 billion people) live under conditions of severe water scarcity at least one month of the year. Half a billion people in the world face severe water scarcity all year.

Half of the world's largest cities experience water scarcity. The essence of global water scarcity is the geographic and temporal mismatch between fresh water demand and availability. The increasing world population, improving living standards were changing consumption patterns, and expansion of irrigated agriculture are the main driving forces for the rising global demand for water. Climate change such as altered weather patterns (including droughts or floods), deforestation, increased population of greenhouse gases and wasteful use of water can cause insufficient supply.

At the global level and on an annual basis, enough freshwater is available to meet such

demand, but spatial and temporal variations of water demand and availability are large, leading to (physical) water scarcity in several parts of the world during specific times of the year. scarcity varies over time as a result of natural hydrological variability, but various even more so as a function of prevailing economic policy, planning and management approaches. Scarcity can be expected to intensify with most forms of economic development, but if correctly identified many of its causes can be predicted, avoided or mitigated. the International Resource Panel of the UN states that governments have tended to invest heavily in largely inefficient solutions: mega projects like dams, canals, aqueducts, pipelines and water reservoirs, which are generally neither environmental sustainable nor

economically viable. The most cost-effective way of decoupling water use from economic

growth according to the scientific panel is for governments to create holistic water management plans that take into account the entire water cycle: from source to distribution, economic use, treatment recycling and reuse and return to the environment.

Name:- Govinda Hira Rathod

Class:- TYBSC (chem)

“आर्थिक शाश्वत विकास आणि पाणथळजागेचे संवर्धन”

पाणथळ जागा म्हणजे नेमकं काय असतं? माझ्या मते “दलदलीचा प्रदेश, जिथे डासांचे राज्य असतं असे ठिकाण”. पण मुख्य प्रश्न हा आहे की, ह्या जागांचे संवर्धन कशाला? प्रथमतः माझ्यामते, तुझ्यामते करण्यापेक्षा पाणथळ जागांवर सखोल अभ्यास केलेला बरा कारण; मी कालच बातम्यांमध्ये ऐकलं आहे की “पाणथळ जागेचे संवर्धन ही काळाची गरज आहे”.

पाणथळ जमीन ही वया गेलेली जमीन नसून आणि कचरा टाकण्याची जागा नसून जैवविविधता आणि पर्यावरणसाखळीचा दुवा आहे. पाणथळजागा म्हणजे जमीन आणि पाणी यांच्या मधील संक्रणात्मक प्रदेश असतो. याभागात विविध जलिय वनस्पतींनी व्यापलेले हंगामी उथळ आढळतात. जैविकविविधता जिवंत ठेवण्यात आणि ते वाढविण्यात पाणथळजागांची भूमिका अत्यंत मोलाची असते.

आर्थिकरित्या पाणथळजागा ह्या खूप महत्वाच्या ठरतात. पाण्याचे नैसर्गिकरित्या शुद्धीकरण करणे, पाण्याची गुणवत्ता शुद्ध राखणे. पर्यावरणाचे संतुलन राखणे, मानव निर्मित मलनिस्सारण करणे, जमिनीची सुपिकता वाढवणे, नैसर्गिकरित्या शेत जमिनीवरील सेंद्रिय घटकांचे संतुलन राखणे, असे प्रत्यक्ष- अप्रत्यक्ष फायदे पाणथळ जागांपासून मिळतात.

पाणथळ जागांमुळे शेती, पशुपालन, मत्स्य- पालन व इतर शेतीपूरक व्यवसायांचा भरभराट झाली आहे. बगळे, बदके, करकोचे, खंड्या तसेच शिकारी प्रजातींच्या व इतरही अनेक पक्ष्यांना पाणथळ प्रदेशातच अधिवास मिळतो. अशा ठिकाणी पक्षांना अन्न मिळत असल्यामुळे सायबेरिया सारख्या परदेशातूनही क्रेन आणि बदके इथे येतात.

सर्वात महत्वाचे म्हणजे पाणथळ जागा साठवण्याचे महत्वाचे काम करतात, पाझरतलाव, विहिरेसाठी ते जलस्त्रोत असतात. इतकंच नाही तर पाणी अडवणे किंवा ते धारण करण्याचे काम या पाणथळजागा करतात. त्यामुळे अशा पाणथळ जागांचे महत्त्व अननयसाधारण असून त्यांचे संवर्धन व्हायला पाहिजे.

सध्या आपण भूगर्भातील पाण्याचा भरपूर वापर करत आहोत. या पाण्याचे पुनर्भरण करण्याचे काम असे प्रदेश करतात. अनेकदा आपण प्रदूषित पाणी व इतर हानिकारक द्रव्ये अशा प्रदेशात फेकतो. तेव्हा पाणथळ जागी वाढणाऱ्या वनस्पती अशा घटकांना गळण्याचे काम करून, पाणी शुद्ध करतात. ज्या कामासाठी म्हणजेच पाणी शुद्ध करण्यासाठी आपण तंत्रज्ञानाच्या मदतीने इतका पैसा टाकून करतो तेच काम पाणथळ जागा आपल्याला नैसर्गिकरित्या मोफत करून मिळतं. ज्यामुळे आर्थिक बचतही खूप होते.

सागरी किनारपट्टीवर असलेल्या अशा गवत्युक्त पाणथळ प्रदेशामुळे लाटांनी होणारी किनाऱ्याची धूप थांबवली जाते आणि वादळपासून होणारी नुकसानही घटते. नदीला पूर आल्यास किंवा अतिवृष्टी झाल्यासही हे जास्तीचे पाणी किनारी पाणथळ पाणथळ प्रदेशात मुरते वा मानवीवस्ती जलमय होण्याच्या धोक्याचे प्रमाण कमी होते.

शहरे व महानगरांच्या बाबतीत पाणथळ जागा ह्या तर खूप मोलाच्या असतात. पावसाचे पाणी जमिनीत मुरते. भुजलांची पातळी वाढते. ओढ्यांचे, नदिंचे अतिरिक्त पाणी साठवून ठेवतात. पूरपरिस्थिती उद्धवणार नाही, यासाठी ह्या तलांची भूमिका महत्वाची असते.

कलोउघात शहरांच्या विकासाच्या नावाखाली झालेलं बेसुमार कामामुळे माणसाने शहरातल्या पाणथळजागांचा नाश केला आहे. घनकचरा, प्रदूषण, अतिक्रमण यांसारख्या कारणांमुळे या जागा लुप्त होत चालल्या आहेत. या सगळ्यांचा परिणाम म्हणजे वातावरण बदलामुळे येणाऱ्या परिस्थितीशी लढण्याची असमर्थता अन्य जीवांचा कमी होत जाणार अधिवास, जमिनीच्या पाणीधारणक्षमतेत घटत्यांचा थेट संबंध सामान्य माणसांच्या जीवनाशी येतो. मात्र आजकाल शेतीसाठी पाण्याचा अनिर्बंध वापर, रासायनिक खते, कीटकनाशके यामुळे बऱ्याच ' पाणथळ ' जागा दूषित होत आहेत. काही ठिकाणी तर चक्र पाणथळजागावर भराव टाकून निवासी वापर, शेतीसाठी जागा उपलब्ध करून घेण्यासाठी बुजवल्या जात आहेत.

शेती आणि पाणथळ जागा हे दोन्ही घटक एकमेकांना पूरकच आहेत. शेतीचा शाश्वतविकास करायचा असल्यास, 'पाणथळ ' जागेचे संरक्षण आणि संवर्धन करणे गरजेचे आहे. संरक्षण आणि पाणथळ जागांचे आपल्या जीवनात असलेले महत्वाचे स्थान जाणून घेऊन प्रत्येकाने स्वतः या संवर्धनासाठी कार्यरत राहावे.

“पाणथळ जागेंच संरक्षण, म्हणजे प्रगतीचे लक्षण.”

आज पाणथळप्रदेशाकडे वाया गेलेली जमीन म्हणूनच पाहिजे जाते. पण जीविक आणि पर्यावरणीय साखळीतील त्यांचे महत्वाचे स्थान लक्षात घेऊन ते जतन करणे, तिथला कचरा इत्यादी दूर करून त्यांचा सजगतेने वापर करणे गरजेचे आहे.

अशा पाणथळ जागा वाचण्यासाठी आपण सर्वांनी सजग राहिले पाहिजे. नियम तोडून बांधकाम करण्याविरुद्ध कायदेशीर लढा, लढा देणाऱ्यांना पाठिंबा, वैचारिक आणि माहिती पुरवण्यानिशी पाठबळ, सामाजिक जागरूकता अशा मार्गांनी आपण रहास थांबवू शकतो.

“पाणथळजागेची जपणूक करूया, शुद्ध पाण्याचा साठा सदाहरित ठेवूया.”

Climate Change, Water Crisis and Wetlands

Reena Vishwakarma

Introduction:-The main Climate change consequences related to water resources Are increases in temperature, Shifts in precipitation Patterns and snow cover, and a likely increase in the frequency of flooding and Droughts. Climate change can Disrupt food availability, reduce access to food, and for example, projected effect on food quality. Increases in temperatures, Changes in precipitation patterns, Changes in extreme weather events, and reductions in water availability may all result in reduced agricultural productivity. Climate change can disrupt Food availability, Reduce Access to food, and affect Food quality. For example, projected increases in Temperatures, Changes in precipitation patterns, Changes in extreme weather Events, and reductions in water availability may all result in reduced agricultural productivity. In the early 1970s, The main obstacle confronting wetland restoration, efforts was developing the Science For successful wetland restoration projects. Although we have made much Progress on that front, The Issue of Climate change may present greater challenges to Wetland conservation and Paper originally produced restoration. This is a policy at their quest of the Scientific and technical, review panel of the Ramsar Convention on wetlands, and incorporates opinion, Interpretation and Scientific-Based arguments. Ramsar convention is the Global intergovernmental.

Water crisis in India..... Treaty which addresses the Conservation and wise use wetlands and climate change: - Increased heat, Drought and in setout breaks, All linked to Climate change, have Increased wildfires. Declining Water supplies, reduced agricultural yields, health Impacts in cities due to heat, and flooding and erosion in Coastal areas are additional Concerns. Wetlands and climate Change wetlands emit 20 to 25 Percent of global methane Emissions to earth's Atmosphere, yet they also Have the best capacity of any ecosystem to retain carbon Through permanent burial (Sequestra-Tion). Both Processes have implications For climate change. Of the Total storage of organic Carbon in earth's soils, 20 to 30 percent or more is stored in Wetlands, And that storage is Vulnerable to loss back to The atmosphere if the climate Warms or becomes drier. This Book excerpt discusses the Significant, Yet underappreciated role of Wetlands in the global carbon cycle. India's water crisis is often attributed to lack of Government planning, Increased corporate Privatization, Industrial and Human waste and government Corruption. In addition, Water Scarcity in india is expected to Worsen as the overall Population is expected to Increase to 1.6 billion by year 2050. Some of the solutions which could be effective in dealing with the water crisis are Listed below: Rain water harvesting, India receives enough rain water annually during monsoon. So rainwater Harvesting should be encouraged on large scale, particularly, in cities where Surface run off of rainwater Is very high. Just hope for the best for the world...

Conservation of Wetlands

Sejal Chawarkar

The issue of wetland conservation and policy has long been an issue of

Controversy among interest groups and industry. When observing the number of endangered species that inhabit wetlands it is apparent that there is a pressing need to conserve them, especially when the leading cause of species is habitat destruction.

What is wetland? A wetland is a distinct ecosystem that is flooded by water, either permanently or seasonally, where oxygen free processes prevail. The primary factor that distinguishes wetlands from other land forms or water bodies is the characteristic vegetation of aquatic plants, adapted to unique hydric soil.

Wetland conservation is aimed at protecting and preserving areas where water exists at or near the Earth's surface, such as swamps, marshes and bogs. There is currently in place a system of policies and laws which culminate to create a relatively effective means of enforcement, however, through the lack of a single Act which pertains to wetlands there continues to be inadequacies within the system. Though the federal government has released the Federal Policy on Wetland Conservation it is not admissible in court and therefore only stands as recommendations by which the government would like the public to abide.

Wetland ecosystems are interconnected and interactive within a watershed. In India, unplanned urbanization and growing population have taken their toll on wetlands. To counter these, management of wetlands has to be an integrated approach in terms of planning, execution and monitoring. Effective tie-ups of trained academicians and professionals, including ecologists, hydrologists, economists, watershed management specialists, planners and decisions makers must be linked with local expertise for overall management of wetlands. All these would increase knowledge and understanding of wetlands and evolve more comprehensive and long-term conservation.

How can we save wetlands? We can join a wetland protection or preservation organization. Volunteer to remove litter from local wetlands. Plant trees, shrubs, flowers that are native to where we live.

Because wetlands have been filled and cleared in recent years, many native plants have disappeared. We can donate to organizations that focus on wetland protection. Many non-profit organizations are underfunded, which limits their efforts. Reduce, reuse and recycle our waste and trash. Protecting the environment helps protect the wetlands especially when trash can make its way to water. Ensure all paper and recycled products in your home are unbleached. Bleached paper can contaminate water once they are thrown away.

Dispose of our household cleaning products responsibly. Never pour any cleaning products down the drain unless the product is specially formulated for that purpose. Avoid applying gardening chemicals on windy or rainy days. Wind and rain can wash chemical fertilizers into storm drains and nearby water resources, including wetlands. Using laundry and dishwasher detergents that are phosphor free. Since the water from the washing machines and dishwashers drains into water supplies, it can contaminate local wetlands.

Report illegal filling, clearing, or dumping activity if you see it occurring. Wetlands are protected areas, so if you see someone dumping waste, cutting down plants and trees or pouring dirt into wetland, we can call our state environmental protection organization. Support lawmakers who advocate for conservation and protection. When it comes time for elections, remember the officials who support conservation efforts.

Spreading awareness by initiating educational programs about the importance of wetlands in local school, colleges and among the general public in the vicinity of the water bodies, besides constant monitoring of wetlands for their water quality, would provide vital input.

हवामान बदल, पाणी संकट आणि आर्द्रता

श्वेता वर्धमान

वाढते प्रदूषण तसेच अन्य कारणांनी हवामान बदलाचे मोठे संकट उभे राहिले आहे. या बदलाचे अनेक क्षेत्रावर होत असलेले दुष्परिणाम समोर येत आहेत. त्यातील कृषिक्षेत्रावरील दुष्परिणाम हा गांभीर्याने विचार करण्याजोगा मुद्दा आहे. त्यामुळे या संकटाचा सामना करण्यासाठी आतापासूनच उपाय योजायला हवेत. त्यादृष्टीने बदलत्या हवामानात तग धरणाऱ्या आणि अधिक उत्पादन देणाऱ्या वाणांच्या निर्मितीवर भर द्यायला हवा. वाढत्या प्रदूषणाचे पर्यावरणावर प्रतिकूल परिणाम दिसू लागले आहेत. त्यातून हवामानातही कमालीचे बदल घडत आहेत आणि ही पररस्थिती शेती, कृषी उद्योग आणि इतर उद्योगांमध्ये यांच्यासाठी अतिशय बाधक ठरणारी आहे. तसेच ही पररस्थिती कीड-रोग यांच्या उत्पत्तीला अनुकूलसुद्धा आहे. सृष्टीच्या हवामानात वेगवेगळे घटक असतात, त्यातील कमी-जास्तपणा म्हणजेच हवामान बदल होय. परंतु अशा बदलांमागील कारणे, त्याचे दुष्परिणाम आणि त्यावरील उपाय यावर सांशोधन करणे आणि त्यानुसार पावले उचलणे ही सध्याच्या काळाची प्रमुख गरज बनली आहे. खरेतर हवामानबदल ही ताबडतोब घडणारी किंवा परिणाम दाखवणारी बाब नाही. ती सातत्याने बदलणारी गोष्ट आहे. मानवाने स्वतःच्या विकासासाठी नैसर्गिक बाबींवर नियंत्रण मिळवण्याचा प्रयत्न सुरू केला. थोडक्यात निसर्गचक्रात ढवळाढवळ निर्माण करण्याचा प्रयत्न सुरू केला तेव्हापासूनच हवामान बदलाच्या संकटाचे बिगुल वाजले, असे म्हणावयास हरकत नाही. त्याचे परिणाम आता कुठे दिसू लागले आहेत. त्यामुळे आता तरी हवामान बदल कशामुळे होतो, त्यावर नियंत्रण कसे मिळवता येईल आणि झालेल्या दुष्परिणामांचा सामना कसा करायचा, यावर गांभीर्यपणे विचार करावा लागत आहे. हवामान बदलाने जगभर सर्वजण धास्तावले आहेत. सन २०१५च्या डिसेंबरच्या पहिल्या आठवड्यात त्यासाठी पॅरिसमध्ये जागतिक परिषद झाली. जगातील सर्व राष्ट्रांचे प्रमुख त्यावेळी या परिषदेत सहभागी झाले. हवामान बदलाचे परिणाम कमी करण्यासाठी उपाययोजना आखल्या गेल्या. कार्बन उत्सर्जनाचे प्रमाण कसे रोखता येईल हाच चिंतनाचा आणि चिंतेचा विषय होता. बहुतांशी देशांनी त्यावर उपाययोजना करण्याचे आणि येणा-या काही वर्षांत उपाय योजण्याचे घोषित केले. हे सर्व खरे असले तरी त्यानुसार कृती आराखडा आखून दरवर्षी त्याचा मागोवा घेणे अपेक्षितही आहे. कोणत्या देशाने काय उपाययोजना केल्या आणि कार्बन उत्सर्जन किती कमी केले हे पाहणे गरजेचे आहे. मात्र त्यावेळी या परिषदेत शेतीचे आणि शेतकऱ्यांचे किती नुकसान होत आहे यावर काहीही चर्चिले गेले नाही. हवामान बदलाने जगातील सर्व देशांची अन्नसुरक्षा धोक्यात असल्याने त्या विषयावर सखोल चर्चा करून शेतकऱ्यांसाठी आणि शेती उत्पादनासाठी नवीन धोरण ठरवणे हे गरजेचे होते. मात्र तसे त्या परिषदेत घडले नाही.

महाराष्ट्रात २१व्या शतकाच्या सुरुवातीपासून मोठ्या प्रमाणात हवामान बदल जाणवू लागले. सन २००० ते २००२ ही सरासरीपेक्षा कमी पावसाची वर्षे होती. सन २००३ हे दुष्काळी वर्ष होते. सन २००४ मध्ये जुलै अखेरपर्यंत पाऊस नव्हता, त्याचा परिणाम खरीप हांगामावर झाला. सन २००५ ते २००७ ही अतिवृष्टीची वर्षे होती. सन २००८ व २००९ मध्ये जून व जुलै महिन्यात पावसात मोठे खंड आणि त्यामुळे खरीपाच्या पेरणीवर परिणाम करणारी जशी ठरली तशीच नोव्हेंबर व डिसेंबर

महिन्यात अवेळी आणि अवकाळी पावसाची ठरली. तसेच सन २००९च्या मार्च, एप्रिल महिन्यांत वादळी वारे आणि पाऊस यामुळे बारामती व इतर भागांत शेतीचे नुकसान करणारी ठरली. सन २००५ साली मुंबई जलमय झाली तर २००६ मध्ये नारायणगाव येथे मान्सूनच्या आगमनाच्या वेळी वादळी वाऱ्याने मोठे नुकसान झाले. सन २००७ साली मान्सून आगमनाच्या वेळी साखर कारखान्यांची उदा. बाबासाहेब आंबेडकर साखर कारखान्याचे छत उडून गेल्याने साखरेचे नुकसान झाले. सन २०१० मध्ये पाऊस चांगला झाला. मात्र नोव्हेंबर व डिसेंबरमध्ये झालेल्या अवेळी आणि अवकाळी पावसाने काढणीस आलेल्या कोकणातील भातशेतीचे प्रचंड नुकसान झाले. सन २०११ हे वर्ष अपुऱ्या पावसाचे होते सन २०१२ साली महाराष्ट्रांत भीषण दुष्काळी परिस्थिती होती. त्यावेळी एकूण १८ जिल्ह्यांतील १२३ तालुके दुष्काळी म्हणून जाहीर करण्यात आले. शेतकऱ्यांच्या जनावरांसाठी सरकारला छावण्या उभ्या कराव्या लागल्या. सन २०१३ हे चांगल्या पावसाचे वर्ष होते, मात्र विदर्भात सरासरीहून अधिक पाऊस झाला आणि काढणीस आलेल्या खरीप पिकांचे विदर्भातील शेतकऱ्यांचे प्रचंड नुकसान झाले. सन २०१४ हे वर्षही सरासरीपेक्षा कमी पावसाचे होते. सन २०१५ साली महाराष्ट्रात भीषण दुष्काळी परिस्थिती उद्भवली आणि मराठवाड्यातील लातूरला रेल्वेवर्गने पाणीपुरवठा करावा लागला. त्या वर्षी दुष्काळाचा पूर्व अंदाज दिला होता. महाराष्ट्रातील २८ जिल्ह्यांतील १३६ तालुके सन २०१५ मध्ये दुष्काळी म्हणून शासनाला जाहीर करावे लागले. जनावरांसाठी छावण्या उभाराव्या लागल्या. हिंदुस्थानातील एकूण धरणांच्या संख्येपैकी ३५ टक्के धरणे महाराष्ट्रात असूनही भीषण दुष्काळी वर्ष मराठवाड्यातील लोकांना पिण्यासाठी पाणी मिळणे दुरापास्त झाल्याने लोक गावे सोडून सांभाजीनगर, मुंबई, पुणे शहरांमध्ये स्थलांतरित झाले. हे स्वातंत्र्यानंतर ६८ वर्षांतील कामाचे फलित आहे का? असे आपणच आपल्याला विचारल्यास त्याचे उत्तर होय असाच आहे. याचा अर्थ आपण नियोजनात चुकलो आहोत असेच आहे.

जेथे मुबलक पाऊस होतो तेथे आपली रिझर्व्हायर किंवा लेक्स असावयास हवीत. सह्याद्री पर्वतरांगांच्या पठारावर असे जलाशयाचे पाणीसाठे असणे गरजेचे आहे. कोणत्याही धरणातून पाणी पुढच्या लोकांना सोडावयाचे झाल्यास हायकोटात दावे होऊ लागले. याचा अर्थ सरळ आहे की आपल्याकडे मुबलक पाऊस असूनही पाऊस अधिक होतो तेथे जलाशये कमी आहेत. याचा विचार भावी नियोजनात होणे गरजेचे आहे. सातारा जिल्ह्यातील महाबळेश्वर येथे सरासरीने ५००० मिलीमीटर पाऊस होतो. मात्र त्याच जिल्ह्यातील म्हसवड येथे सरासरीने २५० मिलीमीटर पाऊस होतो. जेथे पाऊस अधिक आहे तेथे मोठी जलाशये करून जेथे पाण्याचे दुर्भिक्ष आहे तेथे पाण्याचा पुरवठा करणे गरजेचे आहे. मात्र तसे काही प्रमाणात साध्य झाले असले तरी यापुढे असा दृष्टीकोन ठेवून नियोजन, आराखडे बनवणे गरजेचे आहे. तसे न केल्यास अमाप खर्च करून आणि कर्ज उभारूनही उद्दिष्ट गाठणे शक्य होणार नाही.

सन २०१४च्या फेब्रुवारी ते मार्च या काळात विदर्भ व मराठवाड्यात विस्तृत रूपात गारपीट झाली. शेती आणि शेतकऱ्यांचे प्रचंड नुकसान झाले. सन २०१५ साली मार्च ते मे या काळात विस्तृत रूपात विदर्भ, मराठवाडा व पश्चिम महाराष्ट्रात गारपीट झाली. काही म्हशी मेल्या, पक्षी मेले आणि मनुष्यहानीही झाली. शेतीतील उभ्या पिकांचे प्रचंड नुकसान झाले तर सन २०१७ मध्ये मार्च महिन्याच्या १५ व १६ तारखेस पंढरपूर, धाराशीव, बीड, लातूर आणि इतर भागांत विस्तृत रूपात गारपीट झाली. गहू, रब्बी ज्वारी, हरभरा व द्राक्ष पिकांचे प्रचंड नुकसान झाले. त्याच काळात बीज पडून तीन लोकांना आपले प्राण गमवावे लागले म्हणजेच मनुष्यहानीही झाली. ज्या वर्षी मार्च महिन्यात गारपीट झाली त्या वर्षी आगामी मान्सूनवर विपरीत परिणाम झाल्याच यापूर्वी दिसून आले आहे. मान्सून उशिरा दाखल होऊन तो सरासरीपेक्षा कमी झाल्याचे दिसून आले. मात्र यापुढे गारपीट न झाल्यास तेवढा वाईट प्रभाव येणारया मान्सूनवर दिसणार नाही. मात्र यापुढेही गारपीट झाल्यास मान्सूनवर परिणाम होईल.

एकूणच हवामान बदलाने कधी दुष्काळ तर कधी अतिवृष्टी आणि गारपीट तसेच अवेळी आणि अवकाळी पाऊस या सर्व समस्या निर्माण झाल्या आहेत. यातून शेतकरीवर्गाचे आणि शेतीचे नुकसान होत आहे. शेतकरीवर्गाची अधिक स्थिती बिघडत आहे. बँकांचे कर्जाचे परतावे होण्यात अडचणी येत असून शेतकरीवर्गाचे आत्महत्यांचे चित्र कायम राहत आहे. अनेक कारणांपैकी हे एक आत्महत्येचे कारण बनत आहे.

या वर्षी साम टीव्ही, आयबीएन लोकमत, झी २४ तास व जय महाराष्ट्र आणि इतर महत्वाच्या एंथ्रोवन, लोकमत, मिरर इत्यादी वर्तमानपत्रांतून दि. ७ मार्च पासून हवामान बदल वेगाने जाणवतील आणि अवकाळी व अवेळी पाऊस वादळी वाऱ्यासह हमखास होईल असे भाकीत केले होते. तसेच गारपीटीची शक्यताही राहिल असा हवामान अंदाज मी १० ते १४ दिवस आधी दोन वेळा वर्तवला होता. तो मोबाईल व्हॉट्सएपद्वारे वगोने असांख्य शेतकऱ्यांपर्यंत पोहोचला होता. कोणत्या भागात अवेळी व अवकाळी पाऊस होईल तसेच गारपीट होईल हेही वर्तवले होते. त्यामुळे बऱ्याचशा त्या भागातील द्राक्षे बागायतदारांनी आपली द्राक्षे विकण्याचा शिताफीने प्रयत्न केला. परंतु व्यापारीवर्गाने द्राक्षभाव पाडल्याचेही शेतकर्यांनी लक्षात आणू दिले. तसेच बहुतांशी शेतकरीवर्गाने आपल्या गहू, हरभरा व रब्बी, ज्वारी पिकाची काढणी केली. मात्र काही शेतकरी ही कामे मजूर न मिळाल्याने वेळेत करू न शकल्याने त्यांच्या पिकाचे मोठ्या प्रमाणावर नुकसान झाल्याचेही दुसऱ्या बाजूस मला दिसून आले. हळद काढणी करणाऱ्या शेतकऱ्यांनीही आपल्या वाळत टाकलेल्या हळदीच्या हळकुंडांची जमवाजमव करून माल सुरक्षित स्थळी हलवला. मात्र त्यातूनही तूर विक्री करावयास गेलेल्या शेतकऱ्यांची तूर भिजली. यावरून हवामान अंदाजांना फार महत्त्व असून अंदाज वेळेपूर्वी दिला गेल्यास नुकसान वाचू शकते हे दिसून आले. या अंदाजाचा फायदा असंख्य शेतकरीवर्गास झाला.

Economics and sustainable development and Conservation of wetlands

Simran Jha, SPDC

Under the sustainability principle there is a requirement for the sustainable management of environmental resources, whether in their pristine state or through sympathetic utilisation, to ensure that current activities do not impose an excessive cost and loss of options burden on future generations. It has been suggested that it is 'large-scale complex functioning ecologies' that ought to form part of the intergenerational transfer of resources (Cumberland, 1991).

Since wetlands are complex multifunctional systems, they are therefore likely to be most beneficial if conserved as integrated ecosystems (within a catchment) rather than in terms of their individual component parts. Sustainability implies a wider and more explicitly long-term context and goal than environmental quality enhancement. Strong sustainability can be interpreted as requiring that natural resources be considered as essential inputs in economic production, consumption or welfare; or as acknowledging environmental integrity, intrinsic value and rights in nature. Especially when environmental components are unique or environmental processes are irreversible (over relevant time horizons) the latter issues may become important. Very strong sustainability would imply that every component or subsystem of the natural environment should, in principle, be preserved. A somewhat weaker version would focus on ecosystems and environmental assets that are critical in the sense of providing life support services (such as climate control, ozone layer and topsoil provision etc. (Ayres 1993) or non-use values. An even weaker version is that only a minimum amount of certain environmental assets should be maintained because the power of technological change is such that asset substitution will be the rule rather than the exception (Turner 1993a). Environmental sustainability depends mainly on ecosystem stability, resilience and biotic diversity.

Traditional welfare economics focuses more on static equilibrium than on fluctuations and cycles. As a result, it is unable to deal with stability and uncertainty in a way consistent with ecological theory. Integrated systems models and co-evolutionary models may be a step towards a more dynamic and historical understanding of change in interrelated wetland and social-economic systems. On the basis of a strong sustainability criterion, projects should be appraised on a full life cycle basis, since most development projects impinge to some degree on the environment (Pearce, Markandya & Barbier, 1989). Sustainability constraints can be imposed upon an otherwise market-oriented, cost benefit decision making process. By introducing physical constraints to development options, opportunities for future well-being can be preserved rather than trying to impose a structure on future utilities which may be difficult to predict and to control. Wetlands mitigation policy in the US (Marsh et al., 1996) can be considered a specific form of the 'strong sustainability' strategy. The policy requires that the loss of a wetland be compensated for with an alternative wetland of equal physical quality. Of course, there are many problems associated with this scheme, such as defining a measure of physical quality of different wetlands (McCrain, 1992) and issues of locality and broader landscape interactions. Furthermore, such a sustainability orientation assumes a level of analysis and governance in which trade-offs between distinct wetland systems is feasible.

Nevertheless, this scheme does illustrate how sustainability constraints might be introduced, albeit in a pragmatic way.

The process of environmental change manifests itself at a variety of spatial (and temporal) scales - global, regional and local. The importance of the spatial element arises from a reciprocal relationship:

(1) local processes have global impacts. (2) global trends
give rise to local effects.

For example, the loss of ecosystems in some regions may have a large impact on global climatological conditions and geochemical cycles. Over-grazing and deforestation may lead to large-scale soil erosion, downstream sedimentation, flooding and salinisation. The specific spatial environmental and economic structure surrounding wetlands will determine the sensitivity of a region to external environmental and economic forces. From a natural science perspective this will seem to be a straightforward problem of spatial demarcation.

However, from a social-economic perspective defining sustainable development at a spatial or regional level is difficult. A minimum set of conditions for 'local' sustainability would be:

(1) it should ensure an acceptable level of welfare for the regional population, which can be sustained in the future.

(2) it should not be in fundamental conflict with sustainable development at a supra-regional level. Both conditions have implications for choices about changes in wetland areas.

CLIMATE CHANGE, WATER CRISIS & WETLANDS

Name: Tanmay Ganesh Gosavi

College: Satish Pradhan Dnyanasadhana College, Thane

ROLL.NO:53

Climatic Change: Climate change refers to the change in the environmental conditions of the earth. This happens due to many internal and external factors. The climatic change has become a global concern over the last few decades. Besides, these climatic changes affect life on the earth in various ways. These climatic changes are having various impacts on the ecosystem and ecology. Due to these changes, a number of species of plants and animals have gone extinct. When Did it Start? The climate started changing a long time ago due to human activities but we came to know about it in the last century. During the last century, we started noticing the climatic change and its effect on human life. We started researching on climate change and came to know that the earth temperature is rising due to a phenomenon called the greenhouse effect. The warming up of earth surface causes many ozone depletion, affect our agriculture, water supply, transportation, and several other problems.

Although there are hundreds of reasons for the climatic change we are only going to discuss the natural and manmade (human) reasons. Natural Reasons these include volcanic eruption, solar radiation, tectonic plate movement, orbital variations. Due to these activities, the geographical condition of an area becomes quite harmful for life to survive. Also, these activities raise the temperature of the earth to a great extent causing an imbalance in nature. Human Reasons Man due to his need and greed has done many activities that not only harm the environment but him too. Many plant and animal species go extinct due to human activity. Human activities that harm the climate include deforestation, using fossil fuel, industrial waste, a different type of pollution and many more. All these things damage the climate and ecosystem very badly. And many species of animals and birds got extinct or on a verge of extinction due to hunting.

Effects Of Climatic Change:These climatic changes have a negative impact on the environment. The ocean level is rising, glaciers are melting, CO₂ in the air is increasing, forest and wildlife are declining, and water life is also getting disturbed due to climatic changes. Apart from that, it is calculated that if this change keeps on going then many species of plants and animals will get extinct. And there will be a heavy loss to the environment. What will be Future? If we do not do anything and things continue to go on like right now then a day in future will come when humans will become extinct from the surface of the earth. But instead of neglecting these problems we start acting on then we can save the earth and our future. Although humans mistake has caused great damage to the climate and ecosystem. But, it is not late to start again and try to undo what we have done until now to damage the environment. And if every human start contributing to the environment then we can be sure of our existence in the future.

***Water Crisis:** Water is the basic necessity of every human being. But, water scarcity is a major issue that is rising very rapidly in modern-day India. The problem has become so severe that in many states the groundwater has almost dried up and people have to depend on water supply from other sources. In addition, water is one of the most misused commodities that we still waste. It is the central point of our lives but not the central point of our focus. In the past, people understand the value of water and plan their lives around it. Moreover, many civilizations bloom and lost on account of water. But, today we have knowledge but we still fail to understand the value of water. Reason for Water Scarcity Water scarcity is the cause of mismanagement and excess population growth of the water resources. Also, it is a man-made issue that continues to rise. Besides, some of the reasons for water scarcity are: Wasteful use of water for Agriculture- India is one of the major food growers in the world. That produces tons of quantity of food to feed its population and export the surplus that is left. In addition, producing this much food requires a lot of water too.

The traditional method of irrigation wastes a lot of water due to evaporation, water conveyance, drainage, percolation, and the overuse of groundwater. Besides, most of the areas in India use traditional irrigation techniques that stress the availability of water. But, the solution to this problem lies in the extensive irrigation techniques such as micro-irrigation in which we provide water to plants and crops using a sprinkler or drip irrigation. Reduction in water recharge systems- Due to rapid construction that uses concrete and marbles do not let the rainwater to get absorbed in the soil. But, if we install some mechanism in our houses that can hold the rainwater then we can recharge the groundwater.

Lack of water management and distribution- There is a need for an efficient system that can manage and distribute the water in urban areas. Also, the government needs to enhance its technology and investment in water treatment. Besides, we should ensure optimization at the planning level. Solutions to Overcome this Problem Water-free urinal- Urinal waste around 6 liters of water per flush that add up to 25 thousand liters per year. If a male member of the house stops using the flush then they can save lots of water. Close the running tap- During dishwashing and hand washing people often let the tap running. These running taps waste thousands of liters of water per year. Besides, closing the tap will reduce this problem. Replace dripping taps- In India it is commonly seen that most of the houses have one or two taps that drop water even when they are close. This running tap wastes up to 30,000 liters of water that nobody bothers to change. So, we should replace these taps immediately.

To conclude, water scarcity has become a more dangerous problem day by day. Also, due to our leniency that we haven't taken the problem water scarcity seriously. But, now the authorities and people are working to resolve this problem so that our future generations do not have to buy this necessity.

***Wetlands:** Wetlands are complex ecosystems and encompass a wide range of inland, coastal and marine habitats. They share the characteristics of both wet and dry environments and show immense diversity based on their genesis, geographical location, hydrological regimes and substrate factors. They include flood plains, swamps, marshes, tidal marshes etc. Among the most productive life support, wetlands have immense socio-economic and ecological importance for mankind. They are crucial to the survival of natural biodiversity. They provide suitable habitats for endangered and rare species of birds and animals, endemic plants, insects besides sustaining migratory birds.

CLIMATE CHANGE, WATER CRISIS AND WETLANDS

Vaishnavi Tripathi

Satish Pradhan Dnyansadhana College

First of all what are wetland. Wetland is a distinct ecosystem that is flooded by water either permanently or seasonally .primary factor that distinguish wetland from other land forms or water bodies is the characteristic vegetation of aquatic plants adapted to their unique surrounding. Wetland is created naturally. Wetlands are very important part of ecosystem they maintain the water supply carbon emission and controls pollution .

Wetlands store approximately 44.6 million tonnes of carbon per year globally but this was possible when carbon emission was less than 44 million tonnes per year there were good number of wetlands in ecosystem during past time but wetlands started to degrade as development and urbanization started half of the wetlands are degraded in 1900 now according to todays data 36.6 billion tonnes of carbon is created per year globally so how do we expect that wetland will hold this much amount of carbon .while they are historically been the victim of large draining efforts for real estate development or flooding ,for use as recreational lakes or hydropower generation .

Wetlands are created naturally by nature depending upon their surroundings but we in the name of development manipulate the nature according to our convince. We are more focused on creating urbanization jungle by cutting down ,by degrading,by polluting our own environment as wetland depends on their surrounding we are making that surrounding worst day by day minute by minute .

As wetlands are important sink for greenhouse gases,where carbon is stored and prevented from entering the atmosphere but that wetland can be the biggest source of greenhouse gases when their disturbed and we are disturbing their surrounding which results in global warming and climate change .

Now we should also talk about role of wetlands in water crisis .as we know wetlands are nothing but a special type of water body .Wetlands not only store water but also purifies it as many wetlands are converted into agricultural lands they need fresh water in their surrounding or agricultural land near wetlands preserve water quality by removing nitrogen ,phosphorus and pesticides from agriculture runoff,chemicals and nutrients can enter a wetland through surface water and sediments ,or through ground water. Nitrate-N is efficiently removed from wetland surface waters by aquatic plants . As wetland destruction has increased flood and drought damage and this all leads to water pollution which is now converted as water crisis these days . We humans are busy in creating new technology for future to make our life more easy and comfortable but as humans cant see their future they don't know where we are heading by degrading our own home ,our own ecosystem. We are creating waterpurifier for fresh and healthy water but we are the one who are degrading wetlands to make urban jungle lakes ,we change the flow of water for our own needs but we are forgetting that wetlands removes and trap pollutants which helps to purify water,this certainly beats expensive ,humane made filtration system .

We humans are the only big reason for destruction of wetlands .yes of course we are developing new technology we are dreaming to live on the moon and mars but unfortunately we are unable to make our own planet safe and healthy . As we are moving towards future learning new subjects not only learning we are creating new theories but we are keep forgetting about simple geography which we are learning since 4th std that why we need wetlands why we need forest, why , how and what makes our environment healthy for humans and animals .we humans are not only destroying our own future but also we are happily contributing in extinction of endangered species . as we are destructing wetlands we are also destructing their surrounding habitats plants and animals not only plants and animals ,wetlands provides number of occupation to the people living in the surrounding .as wetlands are degrading day by day we are facing climate change ,global warming ,flood unemployment in the places where wetlands is the main occupation. I can't say that we still have time but atleast we can try to improve the condition of wetlands, this time is red alert because WETLANDS ARE DISAPPEARING THREE TIMES FASTER THAN FOREST.

The Climate Change

Name: Vikas Mourya, Class: F.Y.Bcom

Contact number: 8956412145/7738372134

College: Satish Pradhan Dnyanasadhana College, Thane

Climate change refers to the change in the environmental conditions of the earth. This happens due to many internal and external factors. Climate change is one of the most important challenges of humankind in this century. Climate change will affect people all around the world in different ways, though the capacity to cope with it is different among regions and countries. The last Intergovernmental Panel on Climate Change report has provided more evidence regarding the rise in temperature and sea level. Besides, these climatic changes affect life on the earth in various ways. These climatic changes are having various impacts on the ecosystem and ecology. Due to these changes, several species of plants and animals have gone extinct. To see some notable changes, the world is experiencing arbitrary droughts, unexpected weather patterns, and sudden rainfall and snowfall, there is a constant fluctuation in the temperatures leading to disasters like a forest fire, and the weather is no longer predictable enough. The changes are random, and it is getting stressful day by day even to keep track of the changes occurring. These changes have drastically influenced human lives in both positive and negative ways.

Ever since evolution has taken place, humans are continually using nature for their benefits. This has resulted in Some of these are– huge carbon dioxide content in the environment and other harmful materials in the atmosphere and water, the regular use of fossil fuels has led to the complete exhaustion of it. man due to his need and greed has done many activities that not only harm the environment but himself too. Many plant and animal species go extinct due to human activity. Human activities that harm the climate include deforestation, using fossil fuel, industrial waste, a different type of pollution, and many more. All these things damage the climate and ecosystem very badly. And many species of animals and birds got extinct or on a verge of extinction due to hunting. These climatic changes harm the environment. The ocean level is rising, glaciers are melting, CO₂ in the air is increasing, forest and wildlife are declining, and water life is also getting disturbed due to climatic changes. Apart from that, it is calculated that if this change keeps on going then many species of plants and animals will get extinct. And there will be a heavy loss to the environment. Climate change is a major problem that's continuing to arise with the lack of action that states have taken to stop the increase of global warming. This phenomenon affects both national security and human security across the world. Global warming has taken effect in the world over the last century. It is the unusually rapid increase in the Earth's average surface temperature over the past century primarily due to the greenhouse gases released as people burn fossil fuels. Global warming is due to the enhancing greenhouse gas emission and build-up in the Earth's environment. The gases that influence the atmosphere are water vapor, carbon dioxide, dinitrogen-oxide, and methane. Almost 30

percent of incoming sunlight is reflected into space by bright surfaces like clouds and ice. In the other 70 percent, most are absorbed by the land and ocean, and the rest is absorbed by the atmosphere. The absorbed solar energy heats our planet. This absorption and radiation of heat by the atmosphere is beneficial for life on Earth. Today, the atmosphere contains more greenhouse gas molecules, so more of the infrared energy emitted by the surface ends up being absorbed by the atmosphere. By increasing the concentration of greenhouse gases, we are making Earth's atmosphere a more efficient greenhouse. Methane is made while farm animals, such as cattle and sheep digest their food. Cars and trucks can affect climate by releasing carbon dioxide when fossil fuels are burned to power them. When wildfires occur, carbon dioxide is released into the atmosphere. However, if a forest of similar size grows again, about the same amount of carbon that was added to the atmosphere during the fire will be removed. Some effects that scientists have predicted in the past would result when the global change was occurring: loss of sea ice accelerated sea-level rise and more intense heat waves. Scientists have confidence that global temperatures will continue to rise for decades to come, largely due to greenhouse gases produced by human activities.

In conclusion, we need to take part and try to stop global warming and other effects on climate change. If the earth's temperatures continue to rise in the future, living things on earth would become extinct due to the high temperatures. If humans contribute to control global warming, this world would be cooler and the high temperatures we currently have would decrease. If everybody takes the stand and tries to end most of the climate changes that are occurring, this world would be a safer place to live in. If we do not do anything and things continue to go on like right now then a day in the future will come when humans will become extinct from the surface of the earth. But instead of neglecting these problems, we start acting on then we can save the earth and our future.

Wetlands and Water

Aakriti Tamrakar

Abstract: Water is the most essential component for life. Without water there is no life on earth, so in this context I have started some awareness programmes for conservation of water, wetlands & Avifauna. Regarding this, I did pond cleaning at Mahamaya Temple Ratanpur, District Bilaspur (C.G.). This village Ratanpur is known as Land of Pond, more than 150 ponds are there, 22 ponds are private and rest are government and some of them are extinct. This is my own initiative and due to this work I got many appreciation by Nagar Palika Parishad Ratanpur , & still I am busy in this work due to research on wetlands and avifauna. This documentary shows the importance of water and reality without water, so in this era nature needs conservation.

Name: Aakriti Tamrakar (Chancellor Gold Medalist)

Email: greataakriti28@gmail.com

Study of Temporary and Permanent Wetlands in Shirdi

Mubeen Shaikh, Tushar Solase, Rutik Dighe

Department of Zoology, Shri Saibaba College, Shirdi -423109

Abstract: Waste water treatment is a problem that has plagued man ever since he discovered that discharging his wastes into surface waters can lead to many additional environmental problems. Strategies for control of water pollution have focused mainly on implementation of expensive and energy intensive conventional treatment technologies. The limited successes of such strategies can be attributed to the high capital investment requirement, continual replacement and high operation costs. In recent years, constructed wetlands systems have emerged as a low-cost higher forming waste water treatment technology compared to conventional treatment systems. There is a growing interest to develop and adopt this technology for water pollution control in India as well. This documentary gives some introductory information on the concepts, pollutant removal mechanisms, engineering design, construction, vegetation and applications of constructed wetlands for waste water treatment in Shirdi.

Theme 1: Climate change, Water crises and wetlands

Sangita Joshi, PDM

Abstract: Climate change has become a threat to species survival and health of natural systems. As change impacts world's water in many ways. Consider water cycle diagram, it impacts every stage. Frequency of floods, droughts, storms are expected to increase due to climate change. Increase flood run off resulting in a decrease in recharge of floodplains aquifers, change in base flow, altered hydrology, landslide etc. Due to rise in global temperature ocean water level increases. This pose to major threat to island nations and coastal areas. Rise in sea level can cause fresh water to become salty so available fresh water reduces. Due to disasters there are possibilities of contamination of water bodies, increasing the risk of water borne diseases can be seen. Wetland systems are vulnerable to changes in quality and quantity of water supply. Wetlands act as carbon sink, continuously store and remove atmospheric carbon and convert it into plant tissue. Wet lands cover 6% of worlds land surface and contain 12% of global carbon pool. It plays an important role in global carbon cycle. Wetlands are continuous supply of water. Wetlands such as floodplains, river, and swamps etc functions like sponge. They absorbing and storing excess rainfall and in dry season releasing water delaying onset of droughts and minimizing water shortage.

Wetlands & Freshwater resource Management

Shubham M. Nikam

shubhamnikamon@gmail.com

Abstract: Water is an elixir without which any living form could not exist. The Earth has 71 % of water which is solely divided into salty and freshwater. Freshwater accounts for only 2.5% which is distributed into surface sources (rivers, tanks, ponds, glaciers) and ground water (aquifers). Water sustains life, due to which many civilizations flourished along the banks of rivers. They provided a steady supply of drinking water and made land fertile for growing crops, moreover people could be transported easily and the people in this civilization could fish and hunt the animals that came to drink the water. India is an agrarian country and has 4% of total freshwater reserve (India-WRIS wiki 2015) . Being an agrarian country, irrigation is the largest user of India's water reserve with usage of 78% of total water reserve, followed by domestic sector 6% and industrial sector 5%(Press Information Bureau 2013).Groundwater is the major source for irrigation as well as for drinking in both rural and urban areas. Biological oxygen demand (BOD) for most of the rivers of India are increasing and exceeding the standards (Bhardwaj 2005). Arsenic and flouride contamination in ground water is another challenge that India has to combat. Parts like Delhi, Haryana, Jharkand, Kerla, Gujrat, Maharashtra, Odisha are affected by flouride and arsenic contamination (Central Ground Water Board 2010). But due to booming economics, population growth and various other factors has led to water contamination and water scarcity. Due to which the freshwater reserves are depleting and more than 1 billion people lack access to clean drinking water and 2 billion lack adequate sanitation. To overcome these hurdles wetland needs to be protected and conserved. They not only have aesthetic value but also social, economic value in our day to day life. Not only this, we should teach our future generations about water management and try to create awareness among masses. Research should be carried out in this sector and we should adopt various methods that are available to conserve water.

Keywords -water, elixir, freshwater, groundwater, civilization, irrigation, sanitation, wetland, conservation, future generation.

Wetlands for Health and Food Sustainability

Dr. Prasad Karnik ¹, Rupali Shaiwale ²

¹Vice President & ²Project Coordinator

Paryavaran Dakshata Mandal, Thane

Email id: pck.nisargayan@gmail.com, rlshaiwale@gmail.com

Abstract: The importance of wetland for health and food sustainability is focused in this paper. All the wetlands are rich storehouses of natural flora and fauna and thus provide numerous food and medicinal recourses. Adequate, good quality food is a prerequisite for healthy people, and wetlands are key contributors, supplying us with a broad range of wild and cultivated food sources such as fish (including shellfish), certain mammals, plants (rice, seaweeds, a range of leafy vegetables, fruits, and nuts, etc.), reptiles, amphibians, insects and other arthropods, snails and more. Harvesting fish resources from coastal and inland waters has been a source of sustenance and livelihood for millennia. Today one billion people – largely in developing countries – rely on fish as their main or sole source of animal protein. If we protect and conserve the wetlands in their natural conditions, these become sustainable sources of food and medicines.

Keyword: Wetlands, Food, Health

References:

1. http://www.bio.brandeis.edu/fieldbio/medicinal_plants/pages/Common_Cattail.html
2. International Journal of Phytopharmacology Journal homepage: www.onlineijp.com A REVIEW ON TYPHA ANGUSTATA K.Ashok Kumar*, Doreddula Sathish Kumar, V.Arun Teja, V.venkateswarlu, M.Sathish Kumar, Rama Rao Nadendla Department of Pharmacology, Chalapathi Institute of Pharmaceutical Sciences, Guntur, AP, India.
3. [Seafarms.com.au](http://seafarms.com.au) › what-is-the-nutritional-value-of-prawn
4. <https://www.foodprocessing.com.au/content/ingredients/article/creating-chitin-from-prawn-and-fruit-waste>
5. Wikipedia
6. <http://iomenvis.nic.in/>

Sustainable development and conservation of wetlands of Masunda lake

Mrs. Pournima Bhosale-Shirgaonkar

Paryavaran Dakshata Mandal

Email ID: pournimashirgaonkar@gmail.com

Abstract: Thane is known as the 'City of Lakes', because there are more than 30 lakes even existing today. Masunda is one of the lakes. Due to unplanned developments, the area of Masunda Lake is drastically reduced to about 70%. The current area of Masunda Lake is appr. 7.2 hectares. The Masunda Lake supports boat riding, fishing, horse riding along the periphery, public facility, natural drainage, faunal and floral life etc. The current analysis shows that sustainable use of the lake gets good yield and generates substantial economic returns to local inhabitants, especially the fishing community. Therefore even in metropolitan city like Thane, a small lake may prove to be economically viable. The current paper underlines the economic importance of fresh water bodies and takes an overview of the economics of sustainable development and conservation of wetlands of Masunda Lake.

Keywords: economics, sustainable development, Masunda lake, viable yield.

References:

<https://www.google.com/search?q=about+thane&ie=utf-8&oe=utf-8&client=firefox-b>

https://en.wikipedia.org/wiki/Masunda_Lake

https://en.wikipedia.org/wiki/Sustainable_development

https://www.researchgate.net/publication/288267725_The_economic_values_of_the_world%27s_wetlands

Wetland Management: Assessing risk and sustainability solution by Didem Gokce

Text book of environmental studies for undergraduate course by Erach Bharucha

Environmental studies book : STD 11th Commerce

Wetlands of Pampore Kashmir Himalaya and their Conservation

Jahangeer M.R.,^{1*}, Jaya S.,², Ishtiyag A.N.³

¹Department of Environmental Sciences, Madhyanchal Professional University, Bhopal, M.P

²Department of Environmental Sciences, Madhyanchal Professional University, Bhopal, M.P

³Department of Environmental Sciences, Govt. Degree College, Ganderbal, Kashmir, J&K

*E-mail: jahangeerevs@gmail.com

Abstract

Wetlands are highly productive ecosystems as they represent the transition zone between terrestrial and aquatic ecosystems. They are lowlands which receive huge nutrient inputs from the catchment areas. During the present study an attempt was made to estimate and investigate some of the important physicochemical parameters of the water samples of the wetlands of Pampore and suggest conservation measures. The Pampore wetlands are currently suffering from cultural eutrophication. Excess nutrients, specifically phosphorus and nitrogen are the primary pollutants that contribute to the cultural eutrophication of wetlands. From the present study, it can be concluded that the higher values of Phosphates (PO₄), Alkalinity, Hardness, Electric Conductivity, Free carbon dioxide and lower values of DO and transparency clearly depicted higher trophic status of Pampore wetlands. It can also be concluded that climatic factors, untreated sewage and solid garbage from surrounding population, fertilizers containing Nitrates and Phosphates and slit load were the main causes for degradation of water quality of the studied wetlands. Thus powerful control and management mechanisms such as community perceptions and priorities are also required. In order to save them from further contamination and deterioration, urgent remedial steps should also be taken to preserve and sustainably manage these wetlands.

Key Words: Wetlands, Eutrophication, Conservation

Water quality assessment of three different wetland of *Tal* region of Malda district and its impact on aquatic life and socio economic values

Md Ashif Ali¹, Wani Suhail Ahmad¹, Dr Saleha Jamal²

asif4u.amu@gmail.com; salehajm@gmail.com

Research Scholar¹, Associate Professor²

Department of Geography, Aligarh Muslim University, India

Abstract

Wetlands are the most productive ecosystem and continually serving its resources to the human being and other aquatic lives. Wetland plays a vital role in sustaining a wide range of biodiversity and provides goods and services but now, they are of global concern due to their loss in quality and quantity both. The main reasons of degrading wetlands are human intervention and anthropogenic activities. In the present study, water qualities from three wetlands of *tal* region of Malda district have been assessed. The water sample has been collected from three different points of each wetland both pre and post monsoon season. The following parameters have been assessed (ph, conductivity, TDS, hardness, alkalinity, turbidity chloride, temperature, DO and BOD). Questionnaire and interview method has been applied to carry out the study. Water quality index was adopted from the WHO permissible limit, CPCB standards. Study finds that, many of the wetland services have decreased and arrival of migratory birds are also disappearing day by day. Aquatic lives in the wetland mainly different types of fishes, turtles, tortoise and other species are severely affected. Over all degradation of these wetlands also affect the social and economic values. In order to protect the wetlands human intervention, anthropogenic activities should be under control with help of govt department, local authorities and general local public group.

Keywords: Productive ecosystem, Anthropogenic activities, Wetland, Water quality, Aquatic lives.

Ecological study of phytoplankton from Dandi Creek-West Coast of India

Kadam Surendra S.¹ & Samal Deepika V.²

Department of Zoology, ¹ N.B.Mehta Science College, Bordi , Dist.Palghar -401 701

² Sonopant Dandekar college, Palghar, Maharashtra- 401 404

[E-Mail:surendrapices@rediffmail.com, deepikasamal25@gmail.com]

Abstract: Aquatic biodiversity has vast economic value and is mainly responsible for sustaining and supporting overall ecological health. Humans have long depended on aquatic resources for food, medicine and material as well as for recreational and commercial purpose such as fishing and tourism. plankton symbolize life in the water column which control the basic energy source at lower trophic levels and hence form an integral issue the world is currently facing. Dandi creek is an ecologically important coastal ecosystem which is surrounded by heavily industrialized area of Tarapur. Diversity of phytoplankton and water quality of Dandi creek was studied during September 2009 to September 2010. Physiochemical parameters indicated variation in depth, pH, temperature, DO, BOD, and Salinity etc. In the present study the phytoplankton density varied from 88 to 3238 x 10³/l. A total of 59 in Dandi creek genera of phytoplankton were observed from Dandi creek system of which 50 genera were diatoms, 7 were dinoflagellates and 2 were other algae. Coscinodiscus was the most abundant genus in Dandi creek. Followed by Ditylum, Biddulphia, Bacillaria, Certatum, Nitzschia, Naviculla, Plurosigma, Rhizosolenia, Thalassiosira and Thalassiothrix. Variations showed in phytoplankton pigments at Dandi creek waters, the range of chlorophyll a was 0.47 to 6.87 mg/m³ and phaeophytin ranger between 0.18 to 2.8 mg/m³. Concentration of phytoplankton pigments in the system was fairly high with well-defined increases in chlorophyll a from outer to interior part of the creek. In general phaeophytin level is lower than the chlorophyll a values suggesting the healthy ecosystem. Phytoplankton pigments showed variations in concentration during premonsoon, monsoon and post monsoon season at 5 different stations of creek. Dandi creek consists of rich and divers phytoplankton community.

[Keywords: phytoplankton, dandi creek, water quality, physic-chemical parameters]

Economics of sustainable Development & Conservation of wetland

Ansari Iffat Shafique, SPDC

Introduction: A **wetland** is a distinct ecosystem that is flooded by water, either permanently or seasonally, where oxygen-free processes prevail. The primary factor that distinguishes **wetlands** from other land forms or water bodies is the characteristic vegetation of aquatic plants, adapted to the unique hydric soil.

Wetland conservation: Wetland conservation is aimed at protecting and preserving areas where water exists at or near the Earth's surface, such as [swamps](#), [marshes](#) and [bogs](#). [Wetlands](#) cover at least six per cent of the Earth and have become a focal issue for conservation due to the [ecosystem services](#) they provide. More than three billion people, around half the world's population, obtain their basic water needs from inland freshwater wetlands. The same number of people rely on rice as their staple food, a crop grown largely in natural and artificial wetlands. In some parts of the world, such as the Kilombero wetland in Tanzania, almost the entire local population relies on wetland cultivation for their livelihoods.

How to conserve Wetland: 5 Ways to Protect Wetlands:

- Maintain a buffer strip of native plants along streams and **wetlands**. ...
- Use pesticides and fertilizers sparingly. ...
- Avoid non-native and invasive species of plants. ...
- Avoid stormwater run-off and don't pollute. ...
- Keep your pets under control.

Why to conserve Wetlands: **Wetlands** are highly productive and biologically diverse systems that enhance water quality, control erosion, maintain stream flows, sequester carbon, and provide a home to at least one third of all threatened and endangered species.

Wetlands are **important** because they: improve water quality. Provide wildlife habitat.

Wetlands depend on flow from river, dams, diversions and river management have reduced flooding to these Wetlands, altering their ecology and causing the death and poor health Of aquatic biota.

How do wetlands help the economy?: The **economic** benefits **to wetlands** are numerous as well. Improved water quality, flood control, wildlife and fisheries habitat, and recreational opportunities **are** just a few **economic** benefits that **wetlands** provide. ... Keeping them healthy is critical **to** maintain clean water and **to** support wildlife and fish populations.

Economics and Sustainable development as wetland: Under the sustainability principle there is a requirement for the sustainable management of environmental resources, whether in their pristine state or through

sympathetic utilisation, to ensure that current activities do not impose an excessive cost and loss of options burden on future generations. It has been suggested that it is 'large-scale complex functioning ecologies' that ought to form part of the intergenerational transfer of resources (Cumberland, 1991). Strong sustainability can be interpreted as requiring that natural resources be considered as essential inputs in economic production, consumption or welfare; or as acknowledging environmental integrity, intrinsic value and rights in nature.

A somewhat weaker version would focus on ecosystems and environmental assets that are critical in the sense of Providing life support services (such as climate control, ozone layer and topsoil provision etc. (Ayres 1993) or non-use values. An even weaker version is that only a minimum amount of certain environmental assets should be maintained because the power of technological change is such that asset substitution will be the rule rather than the exception (Turner 1993a).

Challenges: The main challenges to sustainable development which are global in character include **poverty** and exclusion, unemployment, **climate change**, **conflict** and humanitarian aid, building peaceful and inclusive societies, building strong institutions of **governance**, and supporting the rule of law.

Wetlands for Health & Food Sustainability

Name: Mrunmayi Dhage

STD/Div.: FYBSC /A STREAM: Science

College: Satish Pradha Dnyansadhna College Thane

The climate started changing a long time ago due to human activities but we came to know about it in the last century. During the last century, we started noticing the climatic change and its effect on human life. We started researching on climate change and came to know that the earth temperature is rising due to a phenomenon called the greenhouse effect. The warming up of earth surface causes many ozone depletion, affect our agriculture, water supply, transportation, and several other problems. wetlands are areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, inc including areas of marine water the depth of which at low tide does not exceed six meters.” Fish ponds, rice paddies, and stabilization ponds and saltpans are human-made wetlands.

Wetlands are among the most productive ecosystems in the world, comparable to rain forests and coral reefs. An immense variety of species of microbes, plants, insects, amphibians, reptiles, birds, fish and mammals can be part of a wetland ecosystem. Climate, landscape shape (topology), geology and the movement and abundance of water help to determine the plants and animals that inhabit each wetland. The complex, dynamic relationships among the organisms inhabiting the wetland environment are called food webs. This is why wetlands in Texas, North Carolina and Alaska differ from one another.

Wetlands and People Far from being useless, disease-ridden places, wetlands provide values that no other ecosystem can. These include natural water quality improvement, flood protection, shoreline erosion control, opportunities for recreation and aesthetic appreciation and natural products for our use at no cost. Protecting wetlands can protect our safety and welfare. Natural Products for Our Economy We use a wealth of natural products from wetlands, including fish and shellfish, blueberries, cranberries, timber and wild rice. Some medicines are derived from wetland soils and plants. Many of the nation's fishing and shell fishing industries harvest wetland-dependent species. In the Southeast, for example, nearly all the commercial catch and over half of the recreational harvest are fish and shellfish that depend on the estuary-coastal wetland system. Louisiana's coastal marshes are tremendously valuable for their commercial fish and shellfish harvest.

Wetlands are habitats for fur-bearers like muskrat, beaver and mink as well as reptiles such as alligators. Fish and Wildlife Habitat More than one-third of the United States' threatened and endangered species live only in wetlands, and nearly half use wetlands at some point in their lives. Many other animals and plants depend on wetlands for survival. Estuarine and marine fish and shellfish, various birds and certain mammals must have coastal wetlands to survive. Most commercial and game fish breed and raise their young in coastal marshes and estuaries. Menhaden, flounder, sea trout, spot, croaker and striped bass are among the more familiar fish that depend on coastal wetlands. Shrimp, oysters, clams, and blue and Dungeness crabs likewise need these wetlands for food, shelter and breeding grounds. Wetlands are important buffers for flood control, can absorb pollutants

and excess nutrients and provide critical habitats for many plants and animals, including some threatened and endangered species. Floodplain development often directly impacts wetlands by removing vegetation (increasing bank erosion), and filling or draining wetlands for building sites. Floodplain development sometimes indirectly impacts riparian wetlands through the installation of artificial stream stabilizing devices like rip-rap and bulkheads that attempt to stop the natural meandering process which creates new wetlands and replenishes existing ones.

Wetlands for health and food sustainability: Limbani J

WETLANDS FOR HEALTH AND FOOD SUSTAINABILITY

What are wetlands ?

Wetlands are areas where water is the primary factor controlling the environment and the associated plant and animal life. They occur where the water table is at or near the surface of the land, or where the land is covered by water.

Total area covered by wetland across the globe is 12.1 million km².



How wetlands benefit food and agriculture!

Wetlands can:

- support fertile soils, reduce erosion and retain sediments and nutrients as well as reduce the potential for salinity and acid sulphate soils
- support aquaculture or grazing
- provide habitat for harvestable plant and animal species
- provide drinking water for stock
- provide shade, wind buffering, protection from floods and habitat for birds
- provide a range of raw products such as timber, stock fodder, salt, peat and firewood
- act as natural filters in waste water treatment
- assist in drought resilience, a key challenge for farmers .



Wetlands Ecosystem services for health and protection against natural calamities

Service	Benefits
Flood control and storm protection	<ul style="list-style-type: none"> • Reduced severity and frequency of onsite flooding. • Reduced probability of excessive groundwater extraction intrusion
Nutrient and other pollution sequestration	<ul style="list-style-type: none"> • Reduced risk of permit violations • Reduced cost of active stormwater treatment
Sediment retention and Shoreline stabilization	<ul style="list-style-type: none"> • Reduced risk of property loss/damage.
Wildlife habitat provisioning for biodiversity	<ul style="list-style-type: none"> • Reduced risk from potential effects on offsite wildlife habitat.



REFERENCES

- Scott S. Shock, P.E. @ www.expotent.com
- Department of Environment @ www.environment.gov.au
- Photo information @ south-asia.wetlands.org

Author

- Jaydeep V. Limbani, student @ Satish Pradha Dnyansadhna College Thane.

Climate change, water crisis and wetlands: Rathod




Need for Conservation of Wetlands: Divya Menga

Need for conservation of wetlands


Protects shoreline against erosion

Wetlands at the margins of lakes, rivers, bays, and the ocean help protect shorelines and stream banks against erosion. Wetland plants hold the soil in place with their roots, absorb the energy of waves, and break up the flow of stream or river currents.




Fertile Farm Land

The staple diet of half the world's population is rice, which grows in wetlands in many parts of the world. Many commercially important fish species, reeds and papyrus are also harvested in wetlands.




Pollution Filter

If trees are the lungs of the planet, then wetlands are its kidneys. Wetlands significantly reduce the nitrates, phosphorus, and heavy metals. Clean and plentiful drinking water depends on healthy wetlands.




Control Flood

As wetlands hold large amounts of water over wide areas, they absorb rainwater runoff and spring snowmelts, slowing the water flow and preventing sudden floods downstream.




Water purification

Natural sediment and minerals will settle in the standing water, but most of the filtration properties come from plants and microorganisms that absorb chemical runoff from agriculture and industry.



Home to Hundreds of species

Wetlands contribute to the high nutrient value of wetland waters and soil, in turn encouraging greater plant richness, which provide food, shelter and breeding habitats for a wide diversity of animals.



Name: Divya Menga

Climate Change, Water Crisis and Wetlands: Vedashree Gholap and Shweta Gupata



Overview of Conference

Dr. Sanjyot Devuskar, Satish Pradhan Dnyanasadhana College, Thane

It's indeed moment of great pleasure for me and Satish Pradhan Dnyanasadhana College to be a part of organizing conference on 'Wetlands and Water' in collaboration with Paryavaran Dakshata Mandal, ATBS and Enviro Vigil. The proposal from PDM came in the month of December and then the process began. It has been a memorable experience to interact and to finalize the details of conference and competitions with the members of PDM. The theme of the conference was of great interest for me being the person from Geography and specialization in Environmental Planning and Management.

We formed various committees at our institutional level for the smooth functioning of all modalities of the conference. Teachers from all faculties were involved in it. And with great pride and pleasure I will like to put on record that they took genuine interest in all modalities of the conference. They encouraged and assisted the students in participating in various competitions. Its impact can be seen from the fact that the number and quality of participation:

Environment, Ecosystems and its role in sustainable development is and should be the topic of concern for every sensible citizen/ human being. We could see that awareness about these environmental aspects is growing day by day. Wetlands play very crucial role in sustainable development by supporting great biodiversity, providing oxygen and acting as sinkholes. They act as flood absorbers and absorb pollutants. Wetlands also provide quality life by supporting fishing and subsistence agriculture. All these contributions of wetlands have been well represented in today's presentation in different competitions by teachers and students from undergraduate and postgraduate levels.

I am thankful to our management- Shri. Kamlesh Pradhan- Secretary Dnyanasadhana, Shri. Satish Sheth- Treasurer, Mrs. Manasi Pradhan- Trustee and Dr. Hemant Chitte for showing confidence and giving all types of support to make this conference possible. (Especially the financial and technical aspects).

I am thankful to all judges of various competitions for patient observation, analysis and finding out the right talent. I am also thankful to the observers of ATBS.

To conclude I will again like to thank each and everyone who contributed to the organisation of the conference. Our very special thanks to the technical team. Sachin karwale, Abhinandan Sawant, and Dr. Sujata Iyer in organisation of the online conference.

Let's hope for sustainable relations with PDM, ATBS and Enviro Vigil and we together at SPDS lets work for our sustainable future.

PHOTOS OF CONFERENCE

1. Flocks of Birds near Vashi Bridge During Creek survey



2. Busy Birds having their food at Thane Creek



3. Kalwa Ganesh Visarjan Ghat Early Morning View



4. Water Sample Collection By Dr. Salaskar



5. Domestic Water Inlet in the Creek



6. Measurement of Transparency at Creek



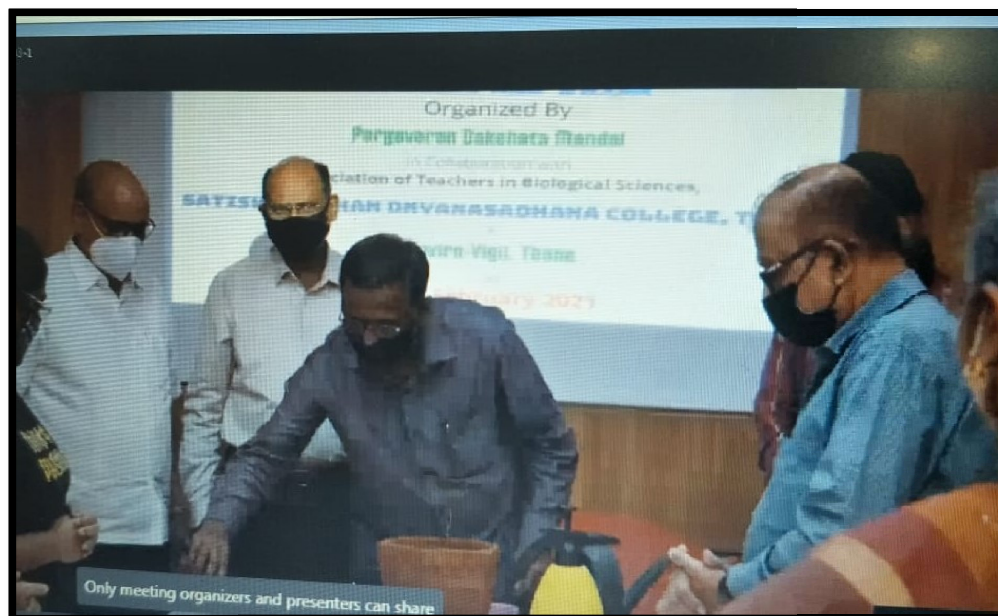
7. Testing of Dissolved Oxygen Level at Creek Site



8. Transparency measurement at Balkum



9. Inauguration of World Wetland Day National Conference by Planting a Sapling At SPDC



10. Release of 'Aapala Paryavaran' Magazine (Feb. 2021)



11. Organizing and Technical Team of Conference at SPDC



12. Felicitation of Hon' Judge Dr. Pejavar Madam

