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Climate Change, Mangrove & Sustainable Management

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Sr. No.	Authors	Title	Page No.
1.	Dr. Dilip Kuralapkar	Mangroves: Unique Ecosystems	**1**
2.	Dr. K. Kathiresan	Mangroves of India : Globally Unique	**4**
3.	Dr. Vinod Dhargalkar	Mangroves to Combat Climate Change	**6**
4.	Dr. Subir Ghosh	Climate change and Sustainable Livelihood in Coastal Maharashtra	**10**
5.	Dr. Bambang Widigdo	Hidden Contribution of Shrimp Farm on Blue Carbon Dynamics	**31**
6.	Dr. Wah Wah Min	Global distribution of crabs in mangrove forests	**37**
7.	Abhinav A. Mali and Ajit M. Tiwari	Ecological and Economic Services of Mangroves	**39.**
8.	Aimana Afrin and Dr. C. Hemavathi	Mangrove Ecosystem	**40.**
9.	Ajit M. Tiwari and Abhinav A. Mali	Mumbai's Vanishing Mangroves: An Alarming Situation	**41.**
10.	Dr. Ajit Kumar Jaiswal	Mangroves Support Biodiversity and Fish Nurseries, Reduce Erosion, Protect Coasts, Regulate The Climate and Provide Resources	**42.**
11.	Dr. Alka Inamdr	Mangroves: The Backbone of Ecosystems	**43.**
12.	Amarja Nitin Joshi	Mangrove Resources	**44.**
13.	Amrendra Kumar and Dr. Ningombam Linthoingambi Devi	Aerosol Characterization Over Mangrove Forest Region In India: A Review	**45.**
14.	Anand Billade and Dr. Mahesh Shindikar	Assessment Of Coastal Blue Carbon From The Mangroves Of Greater Mumbai	**46.**
15.	Aniruddha S. Deshpande and S. N. Malode	Status Of Mangroves In India – A Review	**47.**
16.	Dr. Anita M. Katgaye	Service Of Mangroves For The Benefit of People And Ecosystem	**48.**
17.	Dr. Ashok Tuwar	Diversity of Mangroves from Goa, West Cost of India	**49.**
18.	Dr. Asmathunisha. N., Suji. R, and Dr. Kathiresan. K	Antifoliary activity of gold nanoparticles against *Rhizophoraapiculata*saplings.	**50.**
19.	Dr. Bhaurav T. Dangat	Threats to Mangrove	**51.**
20.	Dr. Bagal J. G.	Mangrove Ecosystem: A Biological Basis For Sustainable Development	**52.**
21.	Dr. Baig Mumtaz	Climate Change ,Mangroves And Sustainable Management	**53.**
22.	Dr. Bhawna Sharma	Save Mangroves Save Nature	**54.**
23.	Dr. Chanchal Garg	Biodiversity and Conservation of Mangrove Ecosystem	**55.**
24.	Chirag Narayankar, Sudarshan Charaplae, Vilas	Restoration and Management Of Mangrove Ecosystem	**56.**

ISBN: 978-93-88901-10-9

	Patil, Dr. Ahilya Waghmode andDr. D.K Gaikwad		
25.	Dr. Vaidehi Baban Chopade	Mangrove Ecosystem Services and Threats	**57.**
26.	Dr. Dinesh K. Dabhadkar And Dr. Nitin M. Raut	Spiders As Bio-Indicators Of Anthropogenic Stress In Natural And Semi-Natural Habitats In Umarkhed Area Of Yavatmal District: Some Recent Developments	**58.**
27.	Deepali Taramati Dhanji Gada	Adaptations For Salinity Tolerance In Mangroves	**59.**
28.	Dr. (Ms.) Deepali Ravindra Mhapsekar	Significance Of Mangroves	**60.**
29.	Dhananjay Rawool and Rahul Chavan	Mangrove Biodiversity And Threats; Location: Bhandup Pumping Station, Airoli, Mumbai, India.	**61.**
30.	Ms. Dipali Anandrav Malvekar	Mangrove The Most Productive Ecosystem On The Planet	**62.**
31.	Ganesh B. Hedawoo and Naved Patel	Mangrove Vegetation In India	**63.**
32.	Dr. Ganesh Chandrakant Nikalje	Threats, Conservation And Sustainable Use Of Mangrove Ecosystem	**64.**
33.	Gavit. M.G and Dr. Sonawane H.B	Biodiversity In Wild Fauna Of Dang Forest Region In Nashikdistrict,Maharashtra	**65.**
34.	Ghadage Sharada Jagannath and Pawar Madhuri A	Conservation Strategies Of Biodiversity	**66.**
35.	Dr. Jakhi P. and Dr. Janabandhu K.S.	Mangrove – Interesting Group of Plants	**67.**
36.	Jitendra Rajendra Patil	Expedition through Ecological and Economic Importance of Mangroves	**68.**
37.	Dr. Jyothi V. Mallia	e-DNA – Biodiversity Conservation Tool	**69.**
38.	Dr. Priyadarshani Baliram Kamble	Mangroves Serving The Ecosystem	**70.**
39.	More K. C.	A Mini Review On Adaptive Strategies Of Mangroves Against Salinity	**71.**
40.	Dr. Kavita Chahal	Climate Change – Change Yourself	**72.**
41.	Kirubha Pauldas	Mangrove Ecosystem	**73.**
42.	Dr. Krupa Unadkat, Prof. Punita Parikh	Diversity of Avicennia species in Gujarat	**74.**
43.	Kuldeep J. Mhatre	Terrestrial Vertebrates Of Mangroves- A Global Perspective	**75.**
44.	Dr. Laxmishree Chengala and Dr. Shital Gharge	Rapid Urbanization Emerging Threat To Mangrove Ecosystems	**76.**
45.	M. J. Kothari and Devidas Narhar Patil	Expedition Through Ecological And Economic Importance Of Mangroves	**77.**
46.	M. Priyadharshini, M.	Effect Of Vermicompost On Growth And Yeild	**78.**

ISBN: 978-93-88901-10-9

	Prakash, S. Manikandan	Parameters Of Mungbean Varieties For Organic Agriculture	
47.	Dr. Madhulika Gupta and Sushreeta Banerjee	Role Of Filamentous Cyanobacteria Isolated From Sundarbans In Environmental Clean Up	**79.**
48.	Mahadik Shaila Shivaji	Mangroves Food Web	**80.**
49.	Dr. MahuyaMukhopadhyay and RanjabatiMitra	Isolation Of Endophytes From *Phoenix paludosa* (Hetal) Of Sundarban Biosphere Reserve And To Explore Their Potentials For Bioactive Compounds	**81.**
50.	Dr. Makarand Mohanrao Aitawade	Mangrove Forest: Its Biodiversity In India & Importance	**82.**
51.	Dr. Nagane Pratishtha N. and Dr. Gaikwad Dattatraya K.	GC-MS Analysis Of Bioactive Components Of Mangrove	**83.**
52.	M. B. Kadel, and Dr. S. S. Rokade	Mangroves Can Help To Reach Our Sustainable Development Goals…(Sdg)	**84.**
53.	Dr. Patkar Namdev Babruvan	Threats And Conservation Strategies For Mangroves	**85.**
54.	Neenu M G	Types of Mangroves	**86.**
55.	Dr. Nitin Manohar Valanju	Threats To The Ocean Due To The Loss Of Mangrove Ecosystem	**87.**
56.	Dr. Nutanvarsha Deshmukh	Mangrove Ecosystem	**88.**
57.	Pallavi V. Singh	Highlights On Role Of Mangroves For Ecosystem Stability	**89.**
58.	Paradesi Anjaneyulu	Importance Of Mangroves	**90.**
59.	Dr. Paras Parmeshwar Jadhav, Dr. D. K. Gaikwad, Laxman Tari, N. S. Daptardar	Mangrove Restoration Camp At Village Taramumbari Tal. Devgad . Dist. Sindhudurg	**91.**
60.	ParulMaurya and Dr. Rina Kumari	Mangrove Forest: Benefits, Threats, Carbon Sequestration Potential, And Management Approaches	**92.**
61.	Dr. Patel Alpa K.	Mangrove Biodiversity And Ecosystem Functions	**93.**
62.	Dr.Payal Rane - Acharekar, Dr. Ambika Joshi, Dr. Nitesh Joshi	Mangroves: A Bane Or A Boon?	**94.**
63.	Pooja Parkar and Dr. Ganesh Nikalje	Isolation And Identification Of Fungal Endophytes From A Mangrove: -*SonneratiaApetala* L.	**95.**
64.	Dr. Prachi Kshirsagar	Mangrove: A Unique Ecosystem	**96.**
65.	Ms. D. Pranita Rao, Dr. (Mrs.) D. Meena Rao	Blue Carbon Farming Through Mangrove Ecosystem	**97.**
66.	Prasanna S. Joshi	Nature-Based Solutions And Human Well-Being	**98.**
67.	Priya. S. and Dr.Shanmuga	Biotechnological Potential Of Mangrove Fungi	**99.**

ISBN: 978-93-88901-10-9

	Priya.R		
68.	Dr. Punita Parikh and Unadkat Krupa	Pollution Load Destructs Mangrove Ecosystem In And Around The World	**100.**
69.	Mr. Rahul Wakde	Threats of Mangrove Ecosystem	**101.**
70.	Dr. Vidya A Patil	Mangrove: Key To The Coast	**102.**
71.	Dr. Vidya Patankar	Anatomy and Ecology Of Mangrove Plant *Sonneratiaapetala*	**103.**
72.	Dr. Jai Godheja	Living On The Edge: Current Status And Threats On Mangroves	**104.**
73.	Dr. Jai Knox	Threats To Mangroves	**105.**
74.	Dr. Ishwari Nitesh Mehta	Mangrove Biodiversity: Yesterday and Today A Statistical Study	**106.**
75.	Dr. PratimaKadam	Role of Mangroves	**107.**
76.	Dr. Rajeshwari P.	A Profile Of Mangrove Ecosystem And Its Restoration	**108.**
77.	Dr. Rashmi, S.	Mangrove Vegetation In Karnataka: An Overview	**109.**
78.	Dr. Rathi M. A.	Environmental Impact Of Mangroves Destruction	**110.**
79.	Dr. Ritesh Kumar Singhal	Save Trees Save Life.	**111.**
80.	Vishal R. Kamble	Tapping the Potential Of Mangrove Forest In Bee Keeping: An Income Generating & Mangrove Conservation Model For India	**112.**
81.	Dr.S.Jenifer	Indian Diversity-Mangroves Ecosystem	**113.**
82.	Dr. S. M. Deosthale	Green Audit: A Tool For The Study Of Climate Change	**114.**
83.	Dr. Sachin N Tayade	Birds (Anseriformes: Anatidae) of Mangrove Forest	**115.**
84.	Salama Suhel Naziri	*Mangroves Ecosystem*	**116.**
85.	Dr. Sampada Patharkar and Dr. G. B. Hedawoo	Mangrove: It Is A Life Of Flora And Fauna	**117.**
86.	Dr. Sandhya R. Moghe and Nishant V. Burade	Role of Phytoremediation By Mangroves Plants	**118.**
87.	Dr. Selvarasuvasuki	DNA Sequencing Analysis For The Identification Of	**119.**

ISBN: 978-93-88901-10-9

	Manikandan, Dr. Priyadharshini Manikandan, Dr. Ganapathy Murugan Alagu Lakshmanan	*Plectranthusamboinicus* (benth.) Species	
88.	Sensei Surendra Sawardekar	Role of Mahim Creek Mangrove- Wetland Diversity	**120.**
89.	Shailaja Puneeth Palan	Mangroves: A Symbiotic Link	**121.**
90.	Shakila Papalal Maldar	The Importance Of Mangrove Wetlands ,Its Pollution,Threats	**122.**
91.	Dr. Mrs. Sharada K. Ulhe-Deshmukh	Conservation & Management Of Aromatic Plants	**123.**
92.	Dr. Shilpa Khairmode	Threats To The Mangrove Ecosystem And Its Conservation	**124.**
93.	Dr. Shilpa Jagtap	Mangrove Biodiversity In India	**125.**
94.	Miss. Shinde Madhumati Yashwant	Present State And Future Of The World's Mangrove Forests"-Blue Carbon; Mangrove Forests Can Help Fight The Effects Of Climate Change	**126.**
95.	Dr. Shital Gharge and Dr. Laxmishree Chengala	Diversity of Mangrove Species In East Coast Of India	**127.**
96.	Dr. Shital S. Taware	Impact of Anthropogenic Activity On Mangroove And coastal ecosystem	**128.**
97.	Mr. Shivdas R. Aher	Threats Drivers Of Mangrove Loss	**129.**
98.	Shreyasi Biswas	Biodegradation Of Polycyclic Aromatic Hydrocarbon By Endophytic Bacteria Of Mangrove	**130.**
99.	ShubhangiRajguruPagare	Threats To Mangrove Ecosystem In Thane District ,M.S; India	**131.**
100.	Dr. Siddhesh Ramesh Patil	Study of ecotourism management with reference to mangrove conservation in Versova region, mumbai	**132.**
101.	Sudipta Paul Bhattacharya and Debolila Bhattacharjee	A Study On The Isolation Of Biofilm Producing Microorganisms And Characterization Of Their Extracellular Polymeric Substances (Eps) From Sundarban Mangrove Area	**133.**
102.	Sujeet S. jadhav	Importance Of Mangroves And Its Threats	**134.**
103.	Dr. Swarupa Agnihotri and	A Short Review On Mangrove Biodiversity	**135.**

ISBN: 978-93-88901-10-9

	Dr. VijayaNikam		
104.	Sweta D. Kedari & Dr. Ganesh C. Nikalje	*Threats to Mangroves Ecosystem*	**136.**
105.	Dr. Urmila Sarkar	Impact of Mangrove Wetland Diversity	**137.**
106.	Vandna Devi and Bhawana Pathak	Ecological Assessment Of Mangroves: A Case Study From Gulf Of Khambhat, Gujarat	**138.**
107.	Vinars Dawane and Dr. Bhawana Pathak	Appliance of High Performance Thin Layer Chromatography In Mangrove Herbal Technology	**139.**
108.	Dr. SuchitaWasudevDighe	Mangrove, Conservation And Importance	**140.**
109.	Dr. Swapnesh S. Rangnekar	Avian Diversity Of Sewri Mangroves Park, Mumbai, India	**141.**
110.	Dr. V.B. Sonawnae	Mangroves Ecosystem Its Threat And Conservation	**142.**
111.	Snehal S. Butle	Nature-Based Solutions for Ecosystem-Related Approaches	**143.**
112.	Dr. Soma Pal Saha	Microbial Biodiversity In Sediment Of Sundarban Mangrove Area	**144.**
113.	Shreya Patel and Punita Parikh	Mangroves: The Tree of Life	**145.**
114.	Dr. Rajendra A. Lavate, Mallappa B. Sajjan, Dipak A. Kumbhar	Mangroves of Maharashtra Coast	**146.**
115.	Rahul Pawar and Dr. N. K.Waghmare	Distrbution of Mangrove in India and their benefits	**147.**
116.	Priyanka Kumari and Bhawana Pathak	Assessment of plant diversity, heavy metal accumulationand sustainable utilization of Mangroves forest of Westsouthern part of the Gujarat	**148.**
117.	Supriya Vaish and Bhawana Pathak	Decolorization of methyl red dye using Avicennia marina bark as biosorbent Pathak	**149.**
118.	Sobiyanaz Arif Momin	Threats to Mangrove Ecosystem	**150.**
119.	Dr. J. T. Jadhav	Mangroves Biodiversity – The Coastal Ecosystem	**151.**

ISBN: 978-93-88901-10-9

120.	Dr. Padmavathi S. Rao	My critical observation of Mangrove Forest of Andaman Island	**152.**
121.	Dr. Pallavi Purushottamrao Ulhe	Positive Effect Of Climate Change On Animals During COVID-19 Lockdown	**153.**
122.	Dr. R. Mary Suja	Manakudy Mangrove Ecosystem Of Kanyakumari District, Tamil Nadu India	**154.**
123.	Dr. R. Shanmug Priya, Ms. Priya S., Mrs. D.R. Darjily	Insights into Mangrove Ecosystem-An Overview	**155.**
124.	Dr. S.D. Shaikh	Studies of Some Coastal Ecosystems Of Western Maharashtra (India)	**156.**
125.	Dr. Sunita H. Jadhav	Mangrove Ecosystem: Importance	**157.**
126.	Dr. Surajit Majumder, and Sulogna Banerjee	A study on variation of physico-chemical and hydrobiological parameters with respect to environmental and anthropogenic factors in a high, moderate and less productive pond of Bankura district of West Bengal	**158.**
127.	Dr. Hemavathi C. and Aimana Afrin	Mangroves Conservation And Ecosystem Services	**159.**
128.	Dr. Meena S. Rao and Dr. Komal A. Kukreja	Study Of Threats To Mangroves Ecosystems	**160.**
129.	Ms. Darjily	Role of Sulphur Oxidizing Bacteria In The Mangrove Ecosystem	**161.**
130.	Ms. Hemangi Gavit	Mangrove Forest Covers in India and Need for Their Conservation	**162.**
131.	Prasanthi Inampudi	Joining Hands To Conserve Mangroves	***163.***
132.	Dr. Sophia. D	Mangroves Ecosystem - Its Importance , Threats And Future Implementations To Conserve It	**164.**
133.	Dr. Poonam Panaskar and Dr. Mansi Patil	Anthropogenic threats to Mangroves	**165.**
134.	Dr. Nanda Jagtap and Dr. Sandesh Jagdale	Study of oil degrading bacteria isolates from Anjarle Creek Tehsil- Dapoli, Dist- Ratnagiri (MS)	**166.**
135.	Dr. Meena S. Chaudhari	Mangroves Ecosystem	**167.**
136.	Dr. Kirtane Sushama Anandrao	Mangroves: The Boon of nature	**168.**
137.	Krishna Gandhi And Punita Parikh	Threats to mangroves and climate change	**169.**
138.	Dr. Priyanka Pravin Jadhav	Importance of Mangroves	**170.**

ISBN: 978-93-88901-10-9

139.	S. Malar Vizhi	Ecological Benefits of Mangrove	171.
140.	Dr.S.S.Jagtap	Sustainable Mangrove Ecosystem- UNESCO Initiative	172.
141.	Mrs. Runali Prashant Raut	**Mangroves: A ray of hope** Mangroves are not waste, they are best.	173.

ISBN: 978-93-88901-10-9

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Title **Mangroves: Unique Ecosystems**

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Mangroves are a group of plants that occur in the coastal intertidal zones of tropics and subtropics. According to Macnae (1968) and Teas (1979) mangroves are trees and shrubs growing in tidal areas protected from high energy tidal currents and wind. Mangroves are salt tolerant forest ecosystems found mainly in tropical and subtropical regions of the world. Mangrove forests are one of the most productive and bio-diverse wetlands on the earth. The distribution of mangroves is influenced by the environmental factors like climate, hydrological as well as other physic chemical conditions of the water and sediments. The most important factor that governs the distribution of mangroves globally is the temperature. Mangroves are sensitive to frost and cold temperature, therefore distributed within 30^{o} N and 30 ^{o} S some species are found beyond this range. Mangroves are found in about 118 countries of the tropical and subtropical coastal regions. Total area under mangroves globally is 137760sq.km.(according to the 2000 estimates, earlier it was about181000sq.km 1993 estimates).Out of total mangrove cover 41% mangrove forests are located in countries like Indonesia, Brazil, Nigeria, Australia. In India mangroves are distributed along east and west coasts. Mangrove forests in India occupy about 4740 sq.km area, out which sunder bans contribute 2106 sq.km, Gujrat 1103 sq.km, Andaman and Nicobar islands 617 sq.km, Andhra Pradesh 367sq.km and Maharashtra 222 sq.km. Sunderban. Bhitarkanika and Pichavaram are world's largest mangrove forests.

Mangrove communities show rich species diversity. According to ENVIS 2016, there are about 96 species of the mangroves distributed among 48 genera and 31 families. According to Tomlinson 2016, there are 55 species of true mangroves

and rest is the mangrove associates. Global record of true mangroves and associates counts about 110 species while sunderbans have 105 species which include true and associate species. According to Tomlinson, True mangroves belong to 20 genera, 16 families among them dominant genera are *Avicennia, Rhizophora, Bruigueria, Ceriops, Kandelia, Sonneratia*, etc. Out total mangrove species of the world India contributes about 56%. Mangroves along coastal Maharashtra are represented by 19 species.

Mangrove ecosystems are unique because they occur in vary specific habitat where the conditions much adverse as compared to the habitats where glycophytes and other fresh water plants grow. Mangroves are found river deltas, lagoons, estuaries, islands etc. of tropical and subtropical regions. Substratum on which they grow is muddy- loose soil, deficient in oxygen.no firmness, more salinity of soil and water, pH is also more, mostly water is brackish i.e. not fresh. To face these adverse conditions mangroves have modified and they have developed prop roots for support, lenticels and neumatophores for oxygen intake, salt regulation mechanisms to avoid the salt or to exclude the salts, vivipary or crypto vivipary for reproduction etc.

The Food chain in Mangrove ecosystems is detritus food chain which starts from mangrove litter falling on the sediments; the decomposed material is source food chain. Food chain includes, crustacean larvae, crabs, mollusks, shrimps, small fishes, big fishes, otters,,birds and mammals. Mangrove ecosystems are rich in biodiversity and globally the harbor about 5700 species of plants and animals. The Bengal tiger, estuarine crocodiles, proboscis monkey, crab eating macaque, swamp deer, sea cows, and otters are the major species which are unique to mangrove ecosystems. There about 240 species of the birds which are recorded from mangrove ecosystems. There about 700 species of the fish which visit mangrove ecosystems once in their life.

Mangroves benefit man directly or indirectly. Mangroves act as carbon sink as they absorb millions of tones of CO2 .Mangroves protect shorelines from damaging storms, hurricanes, energy tides wave, tsunami and floods. Mangroves prevent erosion by stabilizing sediments. These intertidal wetlands, so help in trapping of sediments and filtration of pollutants coming from surface run off. Mangrove wood is durable and water resistant used for making houses, boats, pilings and furniture of different kinds. Charcoal can be achieved from mangroves. They are good source of tannins and dyes. Leaves and barks have medicinal properties. Some people use leaves for preparation of tea. Mangrove forests are big source of honey and sunder bans is the good example of honey production.

There are several threats to mangrove which are due to natural or

anthropogenic activities .Soil erosion and accreditation are the natural threats. Anthropogenic activities include clear cutting of trees for urbanization, industrial development, prawn culture, land reclamation for agriculture, alteration hydrological parameters due to pollution, chemical and oil spill and climate change. *Insitu* conservation is the best method for the conservation of mangroves, for this we have to protect mangrove habitats from human interference. There are several locations along coastal Maharashtra, those can be considered for in situ conservation with special efforts of forest department and help of local inhabitants. In Maharashtra mangrove cell, Botany department ,Shivaji University, Kolhapur and some colleges with the help of local inhabitants are trying for ex situ conservation.

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Title **Mangroves of India : Globally Unique**

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Mangrove forests of India have a total cover of 4,975 sq. km. Of which, Sundarbans in West Bengal has the largest mangrove cover, occupying 42.5%, while Gujarat has the second largest cover with 23.7% of total cover in India. The two areas alone occupy 66% of the mangrove cover, surprisingly in adverse condition of high energy tidal coast, experiencing two extreme situations. For instance, Sundarbans is in humid and wet condition with high biodiversity, whereas the mangrove forest of Gujarat is in arid and dry condition with low biodiversity. Interestingly the Andaman & Nicobar Islands has the third largest mangrove forest in India, occupying 12.4% of the total cover, located in low energy tidal coast with rich biodiversity. In general, mangrove diversity is higher along the east coast and Andaman & Nicobar Islands, but increasingly vulnerable to sea level rise and natural calamities.

India is gifted with 43 mangrove species including four hybrids under 21 genera and 16 families, while the world is represented by 80 mangrove species including 11 hybrids belonging to 32 genera from 17 families. Bhitarkanika in Odisha State is considered to be the 'mangrove genetic paradise' in the world, similar to another one in Baimaru of Papua, New Guinea. In the Bhitarkanika, there is a small island namely "Kalibhanj dia" with an area of about 900 ha , and this is alone endowed with 101 species of mangroves and associates along with larger population of birds and crocodiles especially albino crocodiles. There are several such areas with rich plant diversity, which should be identified along the country and managed as 'Mangrove Germplasm Preservation Centres'. For example, Indian Sundarbans is reported to have 180 floral species that include 34 true mangroves and 71 mangrove associates, 30 back mangroves, 6 epiphytes and parasites, 23 grass and sedges, 4 ferns and 12 herbaceous plants, according to the State-of-art report on "Biodiversity of Indian Sundarbans", published by World Wide Fund for Nature, India.

Sundarbans in India and Bangladesh put together is the largest mangrove forest in the world, and it is also the only mangroves in the world colonized with the Royal Bengal Tigers. It is situated in the Gangetic Delta, which is the largest wetland with the highest sedimentation in the world. It is the dense mangrove forest, unique in extending 100 kilometers inland from the sea front, and the flora and fauna residing here are amazingly adjusted to the rigorously fluctuating tidal environment. However, it is facing a serious threat of sea level rise.

Indian mangrove forests have the highest record of biodiversity with a total of 5,747 species. No other countries have recorded so many species to be present in the mangrove ecosystem. Nine groups of organisms are dominant by exceeding 100 species, and they are mangrove species (true mangroves + mangrove associates), marine algae (phytoplankton + seaweeds), fungi, crustaceans, mollusks, insects, other invertebrates, birds, and finfish. Mangroves harbour most of the groups of animal communities with 30 different groups under 21 phyla from the lowest phylum of Protozoa to the advanced phylum Mammalia. There are a total of 4822 species of animals, which contributes 4.76% of Indian fauna. Other natural treasures along the mangroves in India are: (i) the world's largest nesting site for the Olive Ridley turtle in Gahirmatha coast of Odisha; (ii) seagrass meadows associated with the seacow (Dugong); (iii) coral reefs associated with most beautiful ornamental fishes; and, (iv) intertidal mudflats teeming with the migratory and residential birds, of about 2 million, belonging to 523 species.

Despite increasing pressures, the mangrove cover in India increases annually at the rate of 0.6%, as against the global mangrove cover that disappears at about 0.3%. However, India has a large track of sparse mangrove stand (40.6%). In addition, 16 mangroves and eight mangrove associates are of rare occurrence with restricted distribution. India has two globally- threatened mangrove species namely, *Heritiera fomes* and *Sonneratia griffithii*. The mangroves of India are in vulnerable condition, calling for better conservation and management especially in coastal areas that are vulnerable to climate change and sea level rise. In this regard, the Maharashtra model can be replicated in other states, as it has achieved consistently increasing mangrove forest cover among the states of India.

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Title **Mangroves to combat climate change**

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Today our earth is passing through a very critical stage, wherein humanity is in danger. The virus COVID – 19 that is spreading in nuke and corner of our planet has threatened the very existence of human race. I hope the efforts of our numerous scientists and medical fraternity will restrain and wipe out this virus from our planet soon. "Let us pray to Almighty for His blessings!"

The year 2020 is a super year for biodiversity. In this year 196 parties of United Nations Convention on Biological Diversity (UNCBD) are expected to adopt, a new global biodiversity framework at 15th meeting of Conference of parties (COP15) scheduled to be held in October 2020. The theme of the conference is "**Ecological civilization: building a shared future for all life on earth**"

As you know, Mangroves are dynamic and highly productive ecosystem supporting high biodiversity, characterized by aquatic and terrestrial components that provide a variety of ecological functions and services. Mangroves provide food web support associated with natural processes such as nutrient cycling, primary productivity and nitrogen removal. Ecological services provided by mangroves to humans include carbon sequestration, soil and water quality filtration, flood prevention, climate change mitigation, and many others.

Today mangrove is under tremendous threat from various sources. Mangrove ecosystems have proven to be highly resilient and adaptive, towards many of the common human practices, which include, deforestation, changes in hydrodynamics and direct as well as indirect effects of climate change. Mangroves are expected to respond rapidly and decisively to shifts in key factors, such as temperature, rainfall, and sea level rise as each species has defined ranges of tolerance for each factor.

Rise in temperature

For instance, mangroves are characteristically restricted to elevations, between mean sea level and highest tides, as sea level raises. Their communities must migrate or move upland to survive. Since mangroves have narrow optimal

temperature ranges, rising temperatures will cause their distributions to shift, north or south to areas, where temperature conditions are favourable and they will not survive in areas where such condition are absent. Of course, their success in making these shifts depends largely on their successful dispersal and re-establishment of seeds and seedlings and the availability of ecologically suitable new areas.

Carbon sequestration

Mangroves take part in the global carbon cycle by assimilating organic carbon in biomass, soils and sediments. In recent years, the carbon sequestration capacity of mangroves has been researched worldwide due to the increase in the concentrations of greenhouse gasses that are responsible in global warming and climate change. The coastal ecosystems release the greenhouse gasses such as carbon dioxide, methane and nitrous oxide; these ecosystems maintain high efficiency in offsetting significant amounts of atmospheric carbon. The carbon sequestration capacity of mangrove and factors associated with carbon fixation, production and storage in tidal salt marshes and mangrove ecosystems indicate that mangrove ecosystems is a significant carbon pool ,as compared to other terrestrial ecosystems.

Sea level rise

It is presumed that a rise in mean sea-level may be the most important factor influencing the future distribution of mangroves and that the effect will depending largely on the local rate of sea-level rise and the availability of sediment to support re-establishment of the mangroves. It is also important to note that threats and associated impacts posed by climate change to mangroves cannot be considered in isolation from the many other anthropogenic stressors that have already and continue to negatively impact coastal ecosystems throughout the region. Several studies offer predictive analyses of what may happen to mangroves as a result of the planet warming, sea level rising and the chemical composition of the atmosphere and oceans changes. The IPCC (Intergovernmental Panel on Climate Change) predicted that global sea levels are on the increase and are expected to rise from 0.15 m in 2000 to 1.0 m by 2100. The cumulative impacts of a wide range of coastal disturbances across the region, therefore, present challenges in making precise attribution of specific impacts to mangroves as a results of climate change.

Mangroves as land builders

Mangroves, that exhibit several structural, anatomical and physiological modifications to the saline environment, particularly their root systems. The prop-roots, pneumatophores and networking of cable roots allow mangroves to play a critical role in coastal geomorphology, either as land-builders or as stabilizers of substrates derived from sedimentation processes. Globally, the “land building” sedimentation rate of mangroves is between 1 and 10 mm each year. About 80 percent of sediment deposited by tidal activities is retained by the complex root systems of the mangrove trees. The sedimentation may have some advantages and perhaps the advantages of coastal protection, sedimentation and

land building together with other values of maintaining high biodiversity and flourishing fishery resources.

Extreme natural events

Increasing global temperatures will mean stormier conditions with more erratic rainfall and rising sea levels. Mangroves has an ability to absorb and reduce the impact of strong winds, storm surges and floods that accompany tropical storms as well as tidal waves, Studies have indicated that some areas were able to recover naturally from effect of extreme events while other areas have been **permanently transformed into other ecosystems**. Tsunami waves can also be highly destructive and in extreme cases, such as the 15 m high waves that occurred near the epicenter of the 2004 Indian Ocean Tsunami, However, wherever mangroves were present, they resisted the destructive force and saved land scape and life of thousands of coastal inhabitants.

Fisheries potential

One of the most important services provided by mangrove communities is the provision of a nursery habitat for juvenile fish. The shallow water environment of the mangrove area and the networking of mangrove roots protect these juvenile fish from predators like larger fish and birds. Furthermore, the survival of juvenile fish is aided by the long residence time of water amongst the mangroves, which is facilitated by the mangrove roots. This creates a relatively calm water environment where larvae and juvenile fish can settle. Considering that many commercially important fishes spend some part of their life-cycle in mangrove environments, are likely to suffer fish declines and by association negative economic consequences as a result of climate change.

The climate change will lead to significant changes in the availability and trade of fish products, with potentially important geopolitical and economic consequences. Species productivity and fish growth are already changing with consequences for fishing and farming yields, as a result of shifts in the distribution of fish, alteration of larval transport or thermal tolerance of farmed fishes. This will have negative economic consequences for regional economies and food security of coastal communities and stakeholders

Economic evaluation

Current trends show that the process of economic valuation is continually advancing which gives researchers, at a local, national, regional and even at a global scale tools and methodologies for assessing, quantitative and qualitative value of mangroves. This is particularly important given the role that coastal ecosystems play in sustainable economic development and poverty alleviation. In addition, some studies are beginning to apply “payment for ecosystem service” methodologies” and “blue carbon” values as a means to better understand the natural and socioeconomic values of mangrove ecosystems, that will help in decision making and resource management.

Conclusion

Finally, comprehensive methodologies need to be developed to assess the vulnerability of mangroves to climate change, and thereby help local

stakeholders and policy makers, better understand the socioeconomic costs, associated with climate change impacts on mangroves. Mangroves and tidal wetland habitats can be put to use to monitor sea level and climate change. It is important to identify and describe the key indicators of change within mangroves, so that effective and meaningful integrated mangrove conservation and management plan can be drawn.

Author's Biography

Dr. Vinod K. Dhargalkar, M. Sc., Ph. D. (University of Mumbai) is Ex. Sr. Scientist of CSIR-National Institute of Oceanography, Dona Paula, Goa, worked on coastal marine vegetation - Mangroves, Seaweeds, Sea grasses, Sand dune vegetation and Antarctic biology. Published 105 research papers in national and international journals, 65 technical reports, 45 sponsored project reports, 37 Grant in aid, consultancy and other reports: - 6 books, 6 Editor for field manuals, 4 contributed chapter in Books and 11 popular articles. Filed 6 national patents and one US patent. Developed technology on seaweed bio-fertilizer, technology commercialized and product is in the market in brand name "Planto zyme" . Participated four times in Antarctic Expeditions, Wintered at Davis (Australian National Reserch Station, Antarctica). Dakshin Gangotri (First Indian Antarctic Station, Antarctica), Maitri (Second Indian Antarctic Station, Antarctica). Lead two Winter Antarctic expeditions and one Summer Expedition. Life member of number of scientific bodies/societies. Recognized guide, referee for national and international scientific journals. Visited number of countries for international meetings, conferences, symposiums etc. Presently, Executive Secretary of Mangrove Society of India, Member of Goa State Wetland Authority, Member of Goa State Biodiversity Board, Chairman of the expert committee on People's Biodiversity Register and its validation.

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Title **Climate change and Sustainable Livelihood in Coastal Maharashtra**

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Abstract

The oceans are being increasingly impacted by rising carbon dioxide (CO_2) and other greenhouse gas emissions (GHG) from human activities leading to rise in temperature, ocean acidification and de-oxygenation. These factors are known to cause changes in ocean currents, rise in sea levels, increased storms and surges, as well as degradation of coastal and marine ecosystems. Such loss of habitats and ecosystems on account of climate change ultimately leads to loss of biodiversity and abundance of coastal and marine species. Degradation of coastal and marine ecosystems threatens the economic and food security of local communities. Unsustainable development, resource use and waste disposal further aggravates the problem.

To address these issues, the Government of India, had taken two major steps, the first step being, the launch of two projects with United Nations Development Programme (UNDP) as the lead agency, funded by the Global Environment Facility (GEF), one in Andhra Pradesh, "Mainstreaming Coastal and Marine Biodiversity Conservation into Production Sectors in the East Godavari River Estuarine Ecosystem (EGREE), Andhra Pradesh, India" in the year 2011 and the other in Maharashtra, ''Mainstreaming Coastal and Marine Biodiversity Conservation into Production Sectors in the Sindhudurg Coastal and Marine Ecosystem (SCME), Maharashtra, India'' in the year 2012. Both the projects focused specifically on removing the key barriers for mainstreaming biodiversity conservation into production sectors that impacted the EGREE region and the SCME respectively. The second step of GoI in this direction is the launch of one new project titled, '' Enhancing Climate Resilience of India's Coastal Communities'' with United Nations Development Programme (UNDP) as the lead agency, funded by Green Climate Fund (GCF) in three project states viz. Andhra Pradesh, Odisha and Maharashtra. The outcomes of the UNDP-GEF projects had led UNDP to consider the second project.

The underlying concept and the outcome of mainstreaming biodiversity conservation in the coastal and marine ecosystems is coterminous with the mechanisms of enhancing climate resilience of coastal communities and the same is discussed based on the outcomes

of the Sindhudurg project, implemented on the west coast of India (Maharashtra). The SCME is one of the 11 ecologically and economically critical coastal habitats. The critical habitats include, rocky shore, sandy shore, rocky island, estuaries, mud flats, marshy land, mangroves, coral reefs, and sargassum forests. The marine flora and fauna from the area include, globally significant species viz. Whale shark, Indo-pacific humpback dolphins, Olive Ridley, Green and Leatherback turtles and corals.

The SCME has enormous economic significance, being one of the major fish landing centres and as a rapidly emerging tourism destination. The primary drivers of ecosystem degradation in the SCME include unsustainable fishing, an expanding tourism sector, and pollution from fishing vessels and other maritime traffic. Agrochemical and industrial pollution are relatively limited at present but a precautionary approach is warranted, and climate change poses an impending threat.

The project initiatives made a significant contribution towards mainstreaming coastal and marine biodiversity conservation into the production sectors of Sindhudurg, which include, better adoption of biodiversity conservation strategies by the line departments; capacity building and awareness generation of local communities and government officials in, sustainable fishing, tourism, and agriculture; as well as enhanced capacity of sector institutions towards implementing sustainable and climate resilient livelihood and development of the region.

Introduction

The Ocean and Climate Change

As a result of climate change, the ocean, the coastlines and coastal communities are being impacted by increasing carbon dioxide (CO_2) and other greenhouse gas (GHG) emissions from human activities. As a result of climate change, our oceans are absorbing lion share of the extra energy from the enhanced greenhouse effect, resulting in warming of sea upto depths of 1,000 m. Such changes in temperature impacts the geographical ranges of marine species as well as the diversity and abundance of species communities. Exploration of newer fishing grounds and sustainable fishing as well as increased focus on sea / creek based small scale aquaculture may be pertinent in this context.

The rise in temperature also causes rise in sea levels with significant impacts on shorelines, leading to coastal erosion, saltwater intrusion, habitat destruction as well as coastal human settlements and livelihood. The width of coastal plains in Maharashtra being very narrow (less than 50 km), it is likely to impact agriculture and other land based economic activities on the coast to a large extent. Hence, it may call for adaptation to such climate changes and promotion of newer innovative livelihood activities including, climate resilient agriculture, sea-based livelihood activities such as small scale aquaculture, mangrove crab farming and sustainable ecotourism utilising mangrove habitat, underwater corals and other marine life resources.

Increased emission of CO_2 make the ocean more acidic, making many marine species and ecosystems increasingly vulnerable. Ocean acidification reduces the ability of marine organisms, such as corals, plankton and shellfish, to build their shells and skeletal structures. Reduction in emission of CO_2 and increased carbon sequestration through afforestation of mangroves and seagrass ecosystems as well as conservation of corals may

be necessary.

Moreover, increased GHG emissions exacerbate the impact of already existing stressors on coastal and marine environments from land-based activities such as urban discharges, agricultural runoff and plastic wastes as well as unsustainable exploitation of these ecosystems e.g. overfishing, deep-sea mining and coastal development. The cumulative impact of all these factors , vastly reduces the ability of the coastal and marine environment in rendering the critical ecosystem services.

The sustainable management, conservation and restoration of coastal and marine ecosystems are vital to support the continued provision of ecosystem services on which the coastal communities depend.

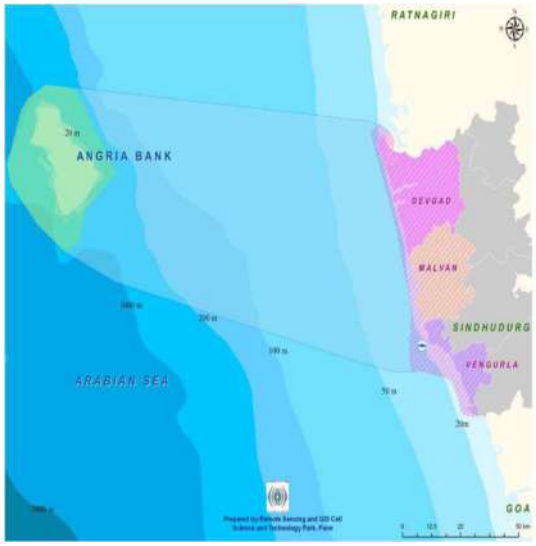
Addressing Climate Change Concerns and Sustainable Livelihood through Appropriate Interventions

To address these issues, the Government of India, had taken two major steps, the first step being, launching of two projects with United Nations Development Programme (UNDP) as the lead agency, funded by Global Environment Facility (GEF), one in Andhra Pradesh, "Mainstreaming Coastal and Marine Biodiversity Conservation into Production Sectors in the East Godavari River Estuarine Ecosystem (EGREE), Andhra Pradesh, India" in the year 2011 and the other in Maharashtra, ''Mainstreaming Coastal and Marine Biodiversity Conservation into Production Sectors in the Sindhudurg Coastal and Marine Ecosystem (SCME), Maharashtra, India'' in the year 2012. Both the projects focused specifically on removing the key barriers for mainstreaming biodiversity conservation into production sectors that are impacting the EGREE region and the SCME respectively. The second step of GoI in this direction is launch of one new project titled, '' Enhancing Climate Resilience of India's Coastal Communities'' with United Nations Development Programme (UNDP) as the lead agency, funded by Green Climate Fund (GCF) in three project states viz. Andhra Pradesh, Odisha and Maharashtra.

The Sindhudurg Project

The concerns of Climate Change and mainstreaming biodiversity conservation in the coastal and marine ecosystems as discussed in this paper is based on the outcome of the Sindhudurg project, implemented in west coast of India, Maharashtra. The new project, ''Enhancing Climate Resilience of India's Coastal Communities'', has built on the outcomes and best practices emanated from the earlier two projects, while focussing on the concerns of Climate Change specifically.

The Sindhudurg Coastal and Marine Ecosystem (SCME)



The total area of the Project site is 6,327 sq.km

Area under direct influence: 2,327 sq.km

- MalvanMarine Sanctuary –29.12 sq.km
- Coastal talukas of Devgad, Malvan and Vengurla–1,653 sq.km
- Angria Bank –645 sq. km

Area under indirect influence: 4000 sq.km

- Marine waters that connect the MMS and Angria Bank

The Sindhudurg Coastal and Marine Ecosystem (SCME), is one of the 11 ecologically and economically critical habitats identified along the Indian coast. Critical habitats include, rocky shore, sandy shore, rocky island, estuaries, mud flats, marshy land, mangroves, coral reefs, and sargassum forests. According to published report (ICMAM, 2002), there are 367 species of marine flora and fauna in the area which include, 73 species of marine algae, 18 species of mangroves, 11 species of coral, 73 species of mollusks, 47 species each of Polychaetes and arthropods, 18 species of sea anemones and 74 species of fishes (ICMAM, 2002). Globally significant species include Whale shark, Indo-pacific humpback dolphins, Olive Ridley, Green and Leatherback turtles, and corals. Avifauna presents 121 species including 24 true migrants (UNDP, 2009). Vengurla Rock is an Important Bird Area (IBA). The area is a rich repository of corals, with the recent discovery of a large coral area in Angria Bank. Due to its high ecological importance, 29.12 sq. km of SCME was designated as the Malvan Marine Sanctuary (MMS) in 1987 and is one of the seven marine Protected Areas in India.

The Issues

The SCME has enormous economic significance, being one of the major fish landing centres and as a rapidly emerging tourism destination. The primary drivers of ecosystem degradation in the SCME were, unsustainable fishing by trawlers, expanding tourism sector, and pollution from fishing vessels and other maritime traffic. Agrochemical and industrial pollution were relatively limited but a precautionary approach was warranted, in addition to impending climate change threats. The institutional arrangements in the SCME were inadequate in addressing these issues from a landscape perspective.

Project Objectives

The sustainable management, conservation and restoration of coastal and marine ecosystems as well as sustainable livelihood being vital to support the continued provision of ecosystem services under climate change projects, is coterminous with the objectives of the projects addressing, main streaming of biodiversity conservation considerations into production sectors in coastal and marine ecosystems. The targets of biodiversity conservation under the Sindhudurg project were, (1) extent of coral cover remaining at least stable or increasing; (2) population status of Olive Ridley turtle remaining at least stable or increasing and (3) population status of Indo-pacific hump back dolphin remaining at least stable or witness increase.

The UNDP-GEF intervention aimed to address this through the following outcomes: (1) cross-sectoral planning framework that mainstreams biodiversity conservation; (2) enhanced capacity of sector institutions for implementing biodiversity-friendly fisheries management plan, ecotourism management plan and MMS management plan; and (3) sustainable community livelihoods and natural resource use. By the project end, it was envisaged that production activities in at least 6,327 sq. km of SCME would mainstream biodiversity conservation objectives, in turn improving the conservation prospects of critical species and ecosystems, apart from contributing to the sustainable development of the region (UNDP, 2009).

Results & Discussions

The Sindhudurg Project made significant contribution vis-à-vis the project objectives which correspond to the following outcomes.

1. Landscape/seascape area in the SCME where production activities mainstreamed biodiversity conservation

Biodiversity conservation was mainstreamed in an area of 6327 Km^2 of the seascape and landscape under the project of which, 2327Km^2 was under direct influence and another 4000Km^2under indirect influence. The area under direct influence comprised of 1653Km^2 of the landscape and another 674 Km^2 of seascape area.

The landscape area under direct influence, comprised of 1653 Km^2 of land area, inclusive of 162 Km^2 of creek area in the three talukas viz. Devgad, Malvan and Vengurla. Mainstreaming of biodiversity in the landscape area of 1653 Km^2 was carried out through a number of activities such as, conduct of participatory rural appraisal (PRA) in project villages with technical support from, The Energy Research Institute (TERI), formation of Biodiversity Management Committees, preparation of People's Biodiversity Registers, preparation of landscape and seascape level plan, assessment of solid waste and preparation of solid waste management plan, mangrove mapping etc. The details are discussed subsequently. Mainstreaming of biodiversity in the 162 Km^2 of creek area, in the three blocks was carried out through a number of activities which included survey of oyster and mussel potentials of these creeks; formulation of guidelines for sustainable bivalve and small scale cage fish farming as well as assessment of potentials of crab farming in association with mangroves; assessment of sustainable eco-tourism potentials and preparation of guidelines; population assessment of Sea otters and Bengal monitor lizards etc.

The seascape area of 674 Km^2,under direct influence, comprised of, 645 Km^2 of Angria Bank and 29 Km^2 of Malvan Marine Sanctuary. The interventions undertaken in these areas comprised of exploration and assessment of biodiversity of Angria Bank and Malvan Marine Sanctuary (MMS). Other conservation programmes undertaken in MMS include, setting up of artificial reef and coral transplant; identification of sites for permanent anchorage points for divers, away from coral sites; community monitoring of coral reefs; eradication of ghost nets from MMS involving trained divers, as part of PADI certified diving course, supported under the project.

The zone under indirect influence, comprised of the seascape of 4000 Km^2 that connect the

MMS and the Angria Bank. Biodiversity conservation was mainstreamed in the area through activities which has positive effect on the marine recruitment through measures such as, use of square mesh nets by trawlers, practice of sustainable marine fishing within the region as well as outside, sustainable dolphin tourism, conservation measures within MMS and the initiative to declare Angria Bank as a marine protected area.

Conservation and restoration of coastal and marine ecosystems

Seascape: Adoption of square mesh net at cod ends of trawl nets; joint patrolling of the sea by Forest and Fisheries Department; cetacean population assessment; turtle conservation; sea snake conservation; survey of corals & associated species; setting of artificial reef & coral transplantation; eradication of ghost net; alternative tourism destination are some of the important interventions in this regard in the coastal waters of Sindhudurg. In addition to the coastal waters, exploration of the marine biodiversity of Angria Bank was undertaken with the involvement of National Institute of Oceanography, Goa (UNDP, 2011).

Landscape: The formation of 'Biodiversity Management Committees'; preparation of village-level micro plans; mangrove mapping and conservation; clean beach campaign; solid waste management, 'Plastic Free Campaign' in Sindhudurg Fort, assessment of green rating for 'Bread & Breakfast units', and baseline population study for sea otters, Bengal monitor lizards, avifauna, are some of the programmes implemented in the landscape of coastal talukas of Sindhudurg. The important interventions are discussed as follows (UNDP, 2011).

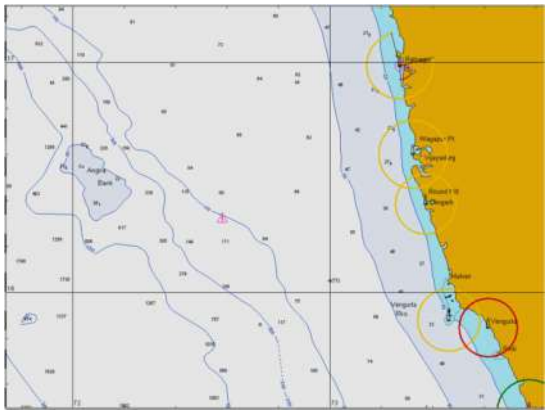
i. **Coral Reef conservation**

Studies on coral and associated species of Sindhudurg was conducted by Zoological Survey of India, (supported by the project) in the target area, reflect a higher biodiversity of corals (21 species) as against earlier reports (11 species).

Another study was constituted under the project to identify degraded coral sites and assess the scope of setting up artificial reef and coral transplantation by the Suganthi Devadason Marine Research Institute (SDMRI), Tamil Nadu and the Bombay Natural History Society (BNHS), Mumbai. The study identified degraded coral sites and assessed the anthropogenic pressures on the corals and associated flora and fauna. Site specific recommendations and interventions by way of setting up of artificial reef and coral transplantation were made and necessary interventions carried out.

- Underwater site of 1 sq. km. area was identified for deployment of Artificial Reef and Coral Transplant
- 437 AR modules and 326 CT modules were deployed
- Permanent plots were marked for monitoring and degraded sites demarcated.
- Anthropogenic pressures on the corals and associated flora and fauna was identified and site specific recommendations made.

A first-ever scientific expedition to assess the marine biodiversity of coral rich area of Angria Bank was carried out. It is a submerged plateau, representing coral reef habitat, located in the Arabian Sea, 60-70 nautical miles off the Sindhudurg coast, covering a submerged area of 645 sq. km. The exploration was taken up under the project with the support of the National Institute of Oceanography (NIO), Goa. The Expedition was carried out using the oceanographic research vessel of NIO, the R.V. Sindhu Sadhana, from 4th to 10th January, 2014.



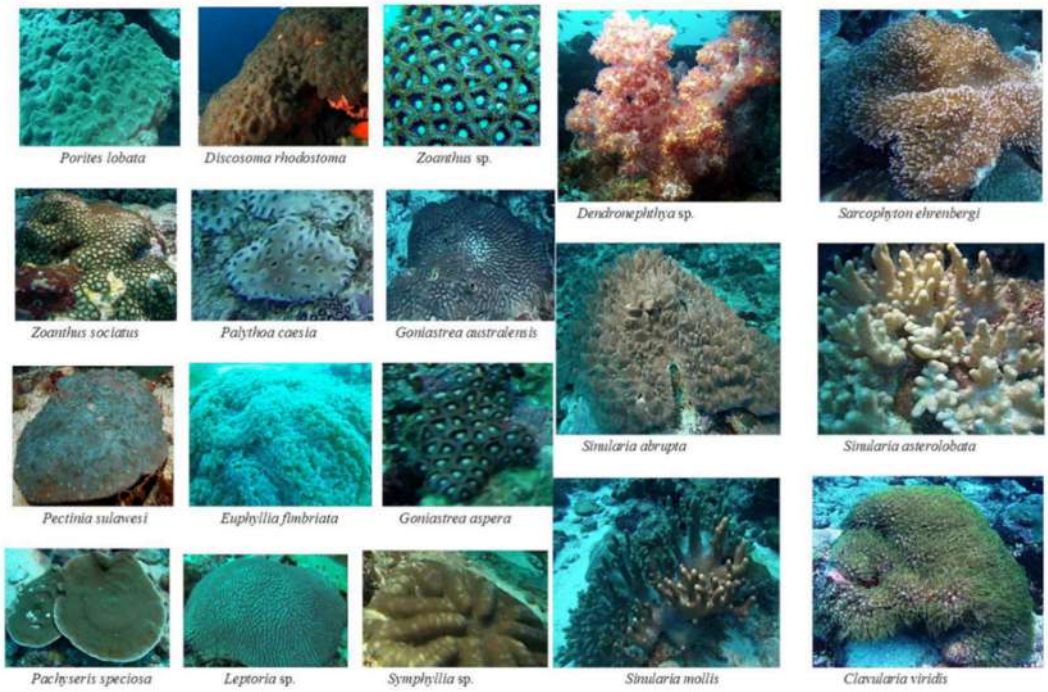
Location Map of Angria Bank

R.V. Sindhu Sadhana

Two major benthic habitats of seaweeds and corals were identified during the study. A total of over 200 marine species were identified. The identified list include, seaweeds, sponges, ctenophores, hard and soft corals, sea anemones, jellyfishes, gastropods, polychaete worms, echinoderms, tunicates and fishes. There were 70 coral species encountered of which, 50 were hard corals and 20 soft corals.

Hard Corals

Soft Corals



The meiofauna diversity was characterised by Nematodes, copepods, polychaetes, amphipods, tardigrades, cumaceas, ostracods, turbellarians and chitons. Considering the diversity of the Angria Bank, the study report has recommended establishing a MPA in the area covering the submerged plateau of 645 sq. km.

Another intervention towards conservation of corals was survey of permanent anchorage points for the tourist boats ferrying tourist to the snorkelling and scuba diving sites in the MMS, in order to minimise impact on corals by dropping of anchor by the boats.

ii. Conservation of Olive Ridley turtles

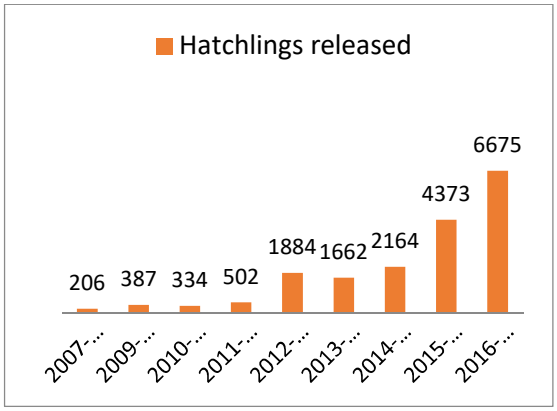
Marine turtles off the coast of Sindhudurg district are impacted by habitat loss, poaching and death due to ensnarement in fishing nets. The breeding of turtles on the coast is impacted by degradation and denudation of beach fronts due to development activities in the coast such as tourism, ports, coastal industrialization, sewage disposal etc. The above factors are known to impact marine turtles whose life cycles are linked with access to the foreshore areas, visited by marine turtles for nesting.

Under the project, Initiatives of the Forest Department of Maharashtra towards conservation of marine turtles was supported which involved, identifying nest and taking care of nests till hatchlings hatch out and are released in the sea. In case the nests are located within the high tide limits, the same are shifted to safe locations on the beaches. Incentives were given to any individual who identified a nest and took care of eggs till hatchlings were released.

Over the project period (5 years), 280 nests were protected and 16758 hatchlings were released. As the result indicate, there was progressive increase in release of hatchlings, which peaked during 2016-17, accounting for conservation of 122 nests and release of

6675 hatchlings. Prior to the Project, in 2011-12, a total of 8 nests were protected and 502 hatchlings were released.

Overview of the Olive Ridley nesting sites in Sindhudurg, sites marked red are sites identified in the past whereas those marked yellow are the new sites identified under the project



Turtle Conservation

iii. Avifauna conservation

The population status of birds in SCME was verified and 253 species recorded, of which 79 were winter migrants, 2 vulnerable, 11 near threatened, 6 Western Ghat endemic species, 100 wetland associated species and 28 shoreline species. As part of the programme, 5 nature trails were identified to promote community based eco-tourism. Local youth were trained to act as guides in these trails.

iv. Cetacean conservation

A study was carried out with technical support of Konkan Cetacean Research Team and Central Marine Fisheries Research Institute, to create baseline data of the cetacean population inhabiting SCME and study the causes of stranding and beaching along the coast. Photo-identification of Indian Ocean Humpback Dolphin was carried out. As part of this, 572 dolphin individuals were identified. The study has also recorded 150 Indian Ocean Humpback Dolphin (*Sousa plumbea*) groups, 65 Indo Pacific finless porpoise (*Neophocaenaphocaenoides*) groups, one Blue whale (*Balaenopteramusculus*) group and eight Bryde's whale (*Balaenopteraedeni*) groups, through direct observation. So far 6 different cetacean species have been recorded throughout the study period.

- 6 different Cetacean species recorded
- 23 incidences of beaching recorded
- Necropsy study carried out in 13 cases
- Stranding and beaching protocol developed
- Efforts on to establish Marine Animal Stranding Management Centre

The other highlights of the study includes, recording of 23 incidences of beaching, necropsy study in 13 cases, and development of a reporting system for stranding and beaching. Awareness material in the form of brochures, posters, booklet were prepared and distributed to fishermen and tourism operators. Three capacity building programmes were conducted, of which, 1 was a National Workshop on Cetacean Monitoring with international experts from 3 countries.

v. Mangrove Conservation

Mapping of mangroves was carried out with technical support from Maharashtra Remote Sensing Application Centre (MRSAC). The mapping exercise included, preparation of village-wise maps for the three coastal talukas of Sindhudurg and mapping of degraded sites. Based on these maps plantation activities were carried out.

Setting up of a Mangrove nursery and Gene Bank for raising RET species was carried out with technical support from the Shivaji University, Kolhapur which resulted in production of 98000 saplings comprising of 23 species. Plantation was undertaken in degraded mangroves identified through the mapping process. In the project area, plantation was carried out in 17 ha of degraded mangroves. Capacity building programs on conservation of mangrove have been conducted, involving local community representatives and Government officials.

vi. Baseline study and conservation plan for Otters and Bengal Monitor Lizard

Apart from the coastal and marine species mentioned above, a study on sea otters and Bengal monitor lizard was carried out with technical support from Ela Foundation. Otters and Monitor Lizards were reported in all 12 creeks. In all, 713 individuals of Smooth-coated otters were recorded. Otters were observed in groups of 2-12.

vii. ***Effect of fishing practices on species assemblages of sea snakes***

The effects of fishing practices on sea snakes was carried out by Dakshin Foundation and it was found that a larger proportion of captured sea snakes were found in trawlers than in gill nets or traditional fishing nets such as the Rampan nets. Two species of sea snake were recorded viz. Shaw's Sea snake and Hook nosed sea snake. There was a marked seasonality in their landing. Whereas, presence of Hook nosed sea snake was maximum during January to March, that of Saw's sea snake was observed from March onwards. Hook nosed sea snake was most predominant and easily identified by local communities. Most fishermen (95%) could identify sea-snakes.

viii. Solid Waste Management

A solid waste management plan was prepared for 23 Village Panchayats (GPs) and the same was accepted by the district authorities for implementation. Regular Clean Beach campaigns were also conducted in the district. The Sindhudurg Fort had been rendered Plastic Free for which the local community living within the fort premises was supported for an activity on solid waste management. A project on integrated solid waste management was prepared and implemented by the Vengurla Municipal Council. The council was supported under the project for installing a Biomass Briquettes making unit.

2. Outcome wise Achievement

Outcome 1: Cross-sectoral planning framework that mainstreams biodiversity

conservation considerations

The outcome was attained through the following interventions:

i. Landscape level zoning plan (LP) that zones resource use by taking into account conservation needs of the SCME was prepared for the project area. A functional cross-sectoral Stakeholder Committee was constituted for the management of SCME involving District Planning Dept, Forest Dept, the Maritime Board, Dept. of Industries, Fisheries, Agriculture, Tourism, Private Sector & NGOs.

ii. Recommendations on reform of Wildlife (Protection) Act

The following points were considered for incorporation in the National Wildlife Action Plan (2017-2031) by the MOEF&CC, towards revision of the Action Plan document, as proposed by the Nodal Officer, UNDP-GEF Project, Sindhudurg

a. As there are no enabling provisions in the Wildlife (Protection) Act, 1972 to declare Marine Protected Areas beyond the territorial waters, nor are there any programs in place to conserve the unique biodiversity of the EEZ, the same was proposed.

b. Although nine species of sharks found in the marine waters have been listed in Schedule-I of the Wildlife (Protection) Act, 1972, an integrated conservation strategy involving coastal states and different stakeholders, is not in place and the same was proposed.

c. Initiated steps for bringing an institutionalized mechanism for handling whale/dolphin beaching cases, including rescue and release operations.

iii. Joint patrolling exercise of forest department, fisheries and police department was initiated in Jan, 2016. The State Government of Maharashtra, vide their Gazette Notification dated 1st December 2016, empowered the Assistant Commissioner of Fisheries, Department of Animal Husbandry and Fisheries, of the seven coastal districts of Maharashtra as "authorized officers" under the Wild Life (Protection) Act, 1972. This step is hoped to bring down the offences under the Act during the coming days. It proved to be an effective measure in mainstreaming marine biodiversity conservation into Fisheries sector.

iv. Recommendations on reform of MMFRA

a. The Commissioner of Fisheries had issued a Govt. order, making it mandatory to use square mesh at cod end of trawl nets for availing subsidy on diesel in Sindhudurg, after successful demonstration and acceptance of the technology by the fishermen in Sindhudurg. This intervention has a huge implication on the recruitment of fishes as a result of escape of juvenile fishes and reduction in fuel consumption owing to lesser drag on the engine. This intervention has rendered trawl fishing more sustainable.

b. As a result of constant dialogue with the Fisheries Department, Government of Maharashtra (GoM), with regard to sustainable marine fishing, the GoM took a decision to regulate the fishing in the territorial waters of the State through suitable incorporations in the MMFRA as follows (excerpts):

- No new licenses for purse seine/ring seine (including mini-purse seine) fishing shall be issued. The number of existing/operational purse seine/ring seine (including mini-purse seine) fishing licenses shall be brought down from 494 to 262 gradually over time and will finally be brought down to 182.
- The purse seine/ring seine (including mini-purse seine) gear shall be operated by

any mechanized vessel, during the period September to December only and within the prescribed zone, leaving near shore area of upto 20-25 m depth, for artisanal fishing.

- No purse seine/ ring seine (including mini-purse seine) gear having less than, 25 mm mesh size for oil sardines and 49 mm mesh size for mackerels shall be operated by mechanized fishing vessels within the territorial waters of the State.

V. The new developments related to tourism, fisheries, ports, mining and agricultural activity in the target landscape, was taken into consideration in preparing the Landscape Plan. Considering the growth of 'Bed and Breakfast' units in Sindhudurg, a draft 'Green Rating System' was designed in compliance with the 'National Green Rating System' and international standards, for the hospitality industry in Sindhudurg. The feasibility of the same was assessed by The Energy and Resources Institute (TERI).

VI. Zoning of MMS in line with Landscape Plan

Several studies for profiling the key biodiversity elements of the SCME including corals & associated flora & fauna, cetaceans, avifauna, mangroves, turtles etc. were carried out. The outcome of these studies will assist in rationalizing the boundaries and zoning of MMS.

VII. Financial sustainability strategy for continued implementation of landscape-level management of SCME

The State Government of Maharashtra has established a Mangrove and Marine Biodiversity Conservation Foundation. This Foundation will provide financial support and mobilize resource towards the continued implementation of landscape-level management of SCME and replicate the best practices from the project wherever feasible.

Outcome 2: Enhanced capacity of sector institutions for implementing biodiversity-friendly fisheries management plan, ecotourism management plan and MMS management plan

The above outcome was attained through the following interventions:

I. A number of representatives from the key sectors (government and private) were trained in mainstreaming and integration of environmental management considerations and safe guards into policies, plans and activities of key sectors. This included, training of 1296 persons from production sector; 1236 persons for the conservation programmes and 2025 persons towards sustainable livelihood.

II. As a result of demonstration of use of square mesh net in trawl gears and conduct of capacity building programmes for the fishermen towards sustainable marine fishing, there was better adoption of the technology by the trawlers. All the 317 trawlers in Sindhudurg adopted the square mesh net in trawl gears. This in turn prompted the State Govt. to make usage of square mesh net mandatory in all the coastal districts.

III. Incidences of encroachment of intensive fishing operations into traditional fishing grounds could be reduced significantly through Joint patrolling activity involving fisheries department, forest department and the police department during the fishing season in 2016 to 2017. This had led to strengthening of implementation of MMFRA, 1981 and WPA 1972. The incidences of conflict between mechanised and

non-mechanised fishing units reduced significantly.

IV. The new developments related to tourism, fisheries, ports, mining and agricultural activity in the target landscape, were taken into consideration in preparing the Landscape Plan and land use zoning map. The activity map indicating current and proposed activities, potential threats to coastal and marine areas and the biodiversity value of each ecosystems was prepared. Fisheries management plan and tourism management plan were also prepared.

V. Community based ecotourism operations in the project area was initiated through five different interventions.

   i. A study on identification and planning for developing alternative tourism destinations was carried out, based on which, 12 sites were identified of which, 4 were recommended for development of underwater marine tourism spots across coastal Sindhudurg.

   ii. Nature trails were created at 5 sites and youths from the local communities were trained in nature interpretation, to act as guides.

   iii. A hospitality management training programme for women beneficiaries was conducted.

   iv. A mangrove Safari programme, partnered by Swamini women SHG and Vengurla Municipal Council was launched.

   v. A community-based eco-tourism model, partnered by Hadi and Wada GP was also launched.

Outcome 3: Sustainable community livelihoods and natural resource use in the SCME

Sustainable community livelihood and natural resource use in the SCME was attained by pursuing the following outcomes which are sustainable and climate resilient livelihood practices.

i. Traditional fishing communities continue to practice sustainable, low-impact, traditional fishing activities.

   The major problems faced by small scale marine fishing sector being in conflict with the mechanized fishing units, the Government of Maharashtra took a decision to regulate the fishing in the territorial waters of the State through suitable incorporations in the MMFRA. The Joint patrolling exercise reduced incursion of mechanized fishing boats within 10 fathom limit earmarked for artisanal fishing units, which is likely to result in increase in fish resources in near shore areas.

i. Alternative livelihoods promoted under the project are listed as follows.

   a. *Mangrove Crab Farming*

   About 40% of the mangroves in Maharashtra are on private lands. These mangroves are being razed for profitable enterprises. Growing crabs in association with mangroves is an innovative way to conserve mangroves since the economic return from crab incentivise mangrove conservation in private land (UNDP, 2011).

Mangrove Crab Farming in Sindhudurg

- Crab farming using pens in association with mangroves was introduced in 17 villages for which, 233 beneficiaries were trained
- These crab pens were stocked with 1,20,658 crablets, in 37 sites in 4 phases
- Around 5000 mangrove saplings were planted under the programme
- The yield assessed from the best case scenario is 525 kg per hectare
- A detailed Environment Impact Assessment (EIA) study to assess the potential for crab farming in Sindhudurg was carried out with technical support of CIBA. The district has around 1,071 ha area is under dense mangroves
- A crab hatchery will be set up to ensure steady supply of crab seeds for scaling up crab farming. INR 15 crore was sanctioned by the State Government for 2017-18 for scaling up this programme

As mangroves provide natural breeding grounds and growing areas for crabs, crab farming in net pens in mangrove areas is an extension of the natural growing process. It provides a good economic activity for the coastal communities as well as promotes conservation of mangroves. It can be promoted even on government land under the umbrella of Joint Forest Management. The activity could reduce pressure on natural crab population of the area, which is under considerable harvesting pressure. Being an open water aquaculture system, it will be able to adapt and cope with rising sea level as a consequence of climate change, flooding coastal areas. To initiate the people of coastal Sindhudurg to mangrove crab farming, a programme was initiated under the GoI-UNDP-GEF project with the technical help of Rajeev Gandhi Centre for Aquaculture (RGCA) and Marine Product Export Development Authority (MPEDA). The activity has become very popular in the region putting pressure on meagre seed resource of the state. A new crab hatchery is being set up in Sindhudurg to meet the demand.

b. Bivalve Farming

Sindhudurg coast is blessed with a vast network of backwaters and creeks. The numerous estuaries and backwaters along the coast have shown significant mussel and oyster resource. In order to utilise the resources and promote mariculture-based livelihood activities, a study was awarded to Colleges of Fisheries, Ratnagiri for mapping the mussel and oyster culture potentials of Sindhudurg. Subsequently, a pilot project was awarded to Central Marine Fisheries Research Institute (CMFRI) for demonstration of mussel and oyster culture practices. As filter feeding bivalves feed on the natural food from the marine environment and hence, bivalve farming is totally 'organic' in nature.

Bivalve Farming

- A pilot project in commercial oyster farming was initiated by empowering 10 women entrepreneurs from Prasiddhi Self Help Group, Wadatar to undertake the activity (UNDP, 2011). The project which started with an initial investment of INR 6,000 in March 2014, resulted in eight fold return

- 24 bivalve farming units were set up and hands-on training was imparted to 182 individuals, of which 164 were women entrepreneurs
- INR 15 crore was sanctioned by the State Government for 2017-18 for scaling up the programme along Maharashtra coast

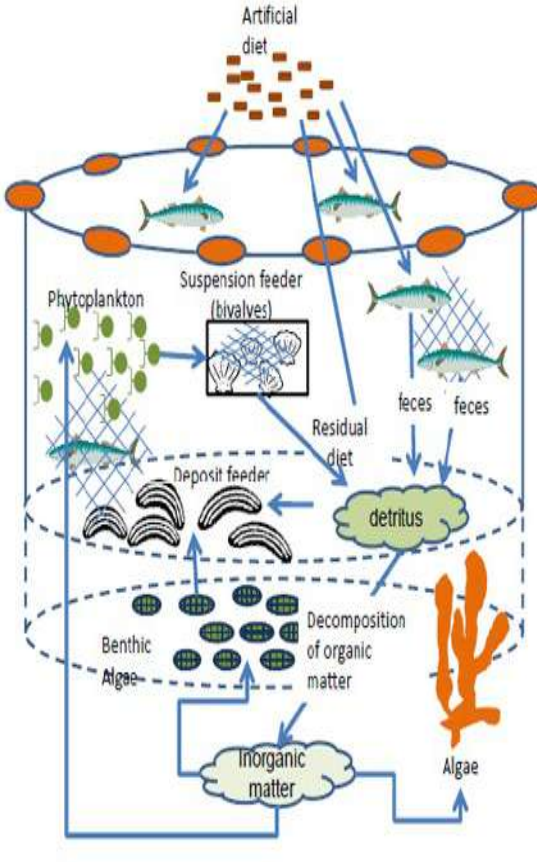
c. Integrated Multi-trophic Aquaculture (IMTA)

Demonstration of Integrated Multi-Trophic Aquaculture was carried out in the three talukas of Sindhudurg district viz. Devgad, Malvan and Vengurla by Central Institute of Brackish Water Aquaculture, Chennai.

The brackish water aquaculture practices are known to generate considerable aquaculture wastes which impact the coastal environment adversely. In order to mitigate the undesirable environmental impacts and to secure sustainable production, there is a global shift from the monoculture system to the polyculture system of aquaculture. Integrated Multi-Trophic Aquaculture (IMTA) systems was promoted as sustainable and practical alternatives to monoculture. The particulate waste matter from fishes is consumed by bivalves and the dissolved ammonia and phosphate wastes from fish is picked up by sea weeds, grown as a component in IMTA.

Integrated Multi Trophic Aquaculture

- IMTA mimics a natural ecosystem.
- Farming multiple complementary species from different levels of the food chain



IMTA Cage culture at Tambaldeg, Devgad

- 2 IMTA models tried (in pens/cages)
- 11 beneficiaries had adopted IMTA
- Total production in pen was estimated to be 4400 kg/ha for milk fish/sea bass/mussels

d. System of Rice Intensification

The *System of Rice Intensification,* known as SRI, is a climate-smart, agro-ecological production system for increasing the productivity of rice and more recently extended to other crops by changing the management of plants, soil, water and nutrients. Experiences from studies on SRI in the last decade have conclusively demonstrated that un-flooded soil is ideal for rice plant to grow well and yield better than under conventional method of continuous shallow submergence. SRI which is relatively a new methodology, involves a set of practices that integrate management of plant, soil, water and nutrients. The potential of SRI is fully realized when all the five important practices are adopted together.

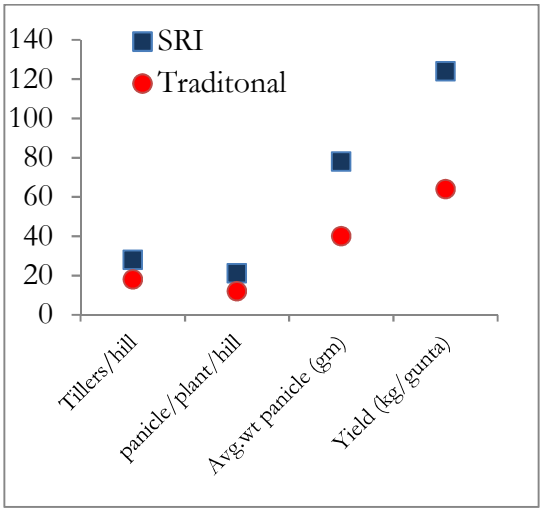
SRI is relevant under the GoI-UNDP-GEF Sindhudurg Project in the context of reduction in eutrophication of coastal waters and pollution due to very low level of use of chemical fertilizers and pesticides. Following SRI, emission of greenhouse gas (methane) is 60% less and that of water use is 40% less compared to traditional practices. The system is drought resilient and offers adaptation to erratic and delayed monsoon due to low seed rate, which is 10% of seed used for paddy cultivation, following conventional practices. Owing to low seed requirement, the farmer can go for a second or even a third nursery in the event of delayed monsoon with progressively shorter duration varieties, which is an adaptation to climate change (UNDP, 2011).

System of Rice Intensification

- Total of 1651 men and 830 women farmers were trained
- In all 413 villages were covered in 8 talukas of Sindhudurg.
- Across four farming seasons, 916 farmers took to paddy cultivation using SRI in 148.14 ha

Scaling up:

- 2768 farmers had taken up SRI in 609 ha of land with the effort of the district administration
- District Administration adopted SRI and proposed to upscale SRI across Sindhudurg with funding support under the "Chanda te Banda" scheme



e. Suitable skill development activities carried out for local institutions for alternative livelihoods or sustainable ecosystem based livelihoods that reduce pressures on biodiversity

A number of Skill development programmes were conducted for local institutions and beneficiaries towards alternative livelihood practices introduced in the project area as follows:

- SRI: 1651 men and 830 women farmers were trained in the activity
- Apiculture: 3 male, 21 female entrepreneurs were trained
- Mussel Oyster Farming: 18 men and 164 women were trained
- Mangrove Crab farming: 233 individuals were trained
- Dive master (completed till rescue diver level): 20 local youth including, 1 female trainee
- Snorkelling guide: 106 men, 1 woman were trained
- Integrated Multi Trophic Aquaculture: 11 men and 4 women entrepreneurs
- Nature Trail: 47 men and 20 women were trained

f. A number of community based ecotourism activities were initiated in the project area (UNDP, 2011). The case of mangrove safari by Swamini Women SHG and that of Alternative tourism destinationsis are discussed here.

Swamini, a Women SHG in Vengurla, had initiated Mangrove Safari in Mandavi creek. The entire tourism activity including mangrove safari, marine life interpretation,

catering services were managed by the group. Appropriate capacity building services were provided under the Project in this regard.

Mangrove Safari

i. 2 row boats and 20 life jackets were provided to the SHG (10 women members)
ii. SHG trained in:
   - mangrove interpretation
   - bird identification
   - hospitality management
   - sustainable fishing
   - importance of mangroves in fisheries
iii. Following the hospitality management training, the SHG set up a restaurant using its own fund
iv. Revenue generated: INR 70,000, earned in 4 months of operation

Partners:

- Vengurla Municipal Council
- Swamini Self Help Group

Alternative tourism destinations

Under the Project, an initiative on alternative tourism destinations was taken to ease the pressure on existing diving areas in Sindhudurg and the benefit of the scuba diving industry goes to local communities through capacity building of the local population in marine interpretation, snorkeling/SCUBA diving, boat operations etc. to generate employment. With the support of Indian Institute of Scuba Diving and Aquatic Sports, Tarkarli, 20 Open water divers and 15 marine interpreters were trained.

Alternative tourism destinations

Partner: Indian Institute of Scuba Diving and Aquatic Sports

- To reduce tourism pressure in Malvan, new sites for underwater tourism were identified and plan for development prepared
- A total of 12 underwater marine sites were identified of which 4 were proposed for development
- Trainings for power boat handling operations and hospitality management were conducted
- Local youths were trained as professional divers and snorkeling guides
- Tourism plan was prepared for the finalized sites incorporating potential of each site, assessment of critical gaps in infrastructure, human resource, monitoring and marketing strategy
- The Sindhudurg district administration had agreed to allocate funds under Village Tourism for

certification of local youth in SCUBA diving and development of Scuba diving centres

i. The number of people shifting to alternative livelihood options that reduce pressure on biodiversity was assessed to be 1246 individuals of which, 916 farmers had taken up System of Rice Intensification, 205 individuals had taken up Mangrove Crab farming, 110 farmers took to bivalve farming and 15 farmers took up Integrated multi-trophic aquaculture (UNDP, 2011).

Summary& Conclusions

Biodiversity conservation was mainstreamed in an area of 6327 Km^2 of the seascape and landscape under the project of which, 2327 Km^2 was under direct influence and another 4000 Km^2, under indirect influence. The area under direct influence comprised of 1653 Km^2 of the landscape and another 674 Km^2 of seascape area.

Important interventions pertaining conservation and restoration of coastal and marine ecosystems included, survey of corals & associated species; setting of artificial reef & coral transplantation; mapping of degraded mangrove areas and their restoration; turtle conservation; sustainable marine fishing through adoption of square mesh net by fishing trawlers; joint patrolling of the sea by Forest and Fisheries Department; cetacean population assessment and sustainable dolphin tourism; eradication of ghost net and creation of alternative tourism destinations to reduce pressure on existing coral sites in Malvan. In addition to the coastal waters, exploration of the marine biodiversity of Angria Bank was also undertaken. Considering their importance to climate change, the UNDP has considered scaling up these conservation programmes under the newly sanctioned project, **'**Enhancing Climate Resilience of India's Coastal Communities**'** (UNDP, 2018)**.**

The Project had demonstrated a three-pronged approach towards mainstreaming biodiversity conservation in the production sectors of agriculture, tourism and fisheries. The first approach involved, preparation of sector-wise plans, mapping of critically vulnerable sites, and assessment of the biodiversity and baseline estimates wherever needed. This had facilitated a better adoption of biodiversity conservation strategies by the line departments, as visible from several policy changes made during the course of the project implementation.

The second approach was capacity building and awareness generation of local communities and government officials in sustainable fishing, tourism, and agricultural practices, including introduction of new activities and encouraging adoption of sustainable practices in existing activities. One of the notable interventions in this regard was the use of square mesh nets in trawling, which allowed escape of juvenile fishes, thereby ensuring better recruitment and maintenance of fish stock as well as sustainable marine fishing. All 317 trawlers in Sindhudurg had adopted the technology, considering the sustainability and economic advantages, taking into account lowers diesel consumption due to reduced drag on the engine. The Fisheries Department of Maharashtra supported the programme and extended the technique to the entire Maharashtra coast.

The third approach was promotion of sustainable livelihood practices that emphasize sustenance of healthy coastal ecosystems, such as mangrove crab farming, oyster and

mussel culture in creeks, mangrove safari, eco-tourism, integrated multi-trophic aquaculture and paddy cultivation following the System of Rice Intensification technique (a climate resilient farming technique, which reduces pressure on land and water, reduces fertiliser use and seed requirement as well as emission of GHGs). The ecological and economic benefits of these livelihood practices have been acknowledged widely from sustainability point of view as well as from the point of adaptation and mitigation of the impacts of climate change. The line departments have mainstreamed most of the activities under the various Government schemes. The SRI has been adopted by Agriculture Department for scaling up to 60,000 ha in Sindhudurg and a budget of INR 24 crore was allocated to the Mangrove Cell for promoting crab, mussel and oyster farming across Maharashtra as well as for setting up a crab hatchery. Considering their adaptation to climate change, the UNDP has considered scaling up these practices under the newly sanctioned project, 'Enhancing Climate Resilience of India's Coastal Communities' (UNDP, 2018).

The significant progress made vis-à-vis the project objectives and outcomes of the project, particularly the policy level changes brought about in mainstreaming biodiversity conservation into the costal and marine ecosystem, prompted the UNDP to rank the same as best practices and considered scaling up the activities under the recently sanctioned climate change project. Taking into account, the participation of the local communities in conservation of marine life and environment as well sustainable livelihood activities, the State Govt. considered co-financing the project as well support the organizational entity viz. the Mangrove Foundation, created for sustenance of the project objectives and goals beyond the project period. Thus, the outcome is highly fulfilling and worth replicating in similar coastal areas, to bring about transformational changes in coastal and marine biodiversity conservation as well as promotion of sustainable livelihood, which in turn could address the future challenges in terms of climate change.

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Author's Biography

Dr. S. K. Ghosh is a former Agricultural Research Service Scientist of 1976 batch, working for Indian Council of Agricultural research (ICAR). After serving ICAR as a Fishery Scientist for 10 years, he joined the technical services of the National Bank for Agriculture and Rural Development (NABARD) and retired from service as General Manager in 2012. Post-retirement Dr. Ghosh worked for the Mangrove Cell, Forests Department, Govt. of Maharashtra, as a Project Coordinator of the UNDP-GEF project, "Mainstreaming Coastal & Marine Biodiversity Conservation into Production Sectors in the Sindhudurg Coastal & Marine Environment (SCME), Maharashtra, India''

Dr. Ghosh is a Ph.D. in Marine Science from the University of Calcutta; Post-graduate in Fishery Science from the University of Delhi and Post-graduate in Aquaculture Planning and Management from the University of Hull, UK. He is also a qualified auditor in Hazard Analysis and Critical Control Point (HACCP) from the Royal Institute of Public Health & Hygiene, London, UK.

He was involved in standardization of aquaculture technology utilizing the running water resources in the hills and cold tolerant hill stream fish species as a Fishery Scientist, besides working on conservation of mahseers and Icthyofauna of the NE Hill states. He carried out research work at the University of Hull, UK on 'Environmental planning for marine cage fish farming following, Norwegian coastal zone planning system "LENKA and MOM'', during 1997-98.

As a development banker, he looked after Bank's development as well credit functions, beside implementation of projects of national importance pertaining agriculture and rural development, rural infrastructure, rural employment, sustainable livelihood, conservation of environment and climate change. He was involved in implementation of two major aquaculture programs, in the country i.e. IDA sponsored Inland Fisheries Program in five states of India during the 1980s as well as coastal aquaculture development during the 1990s, through institutional finance. He was also involved in promotion of sustainable marine fishing and planning.

Presently Dr. Ghosh is engaged as an independent consultant, working for UNDP and NABCONS, a subsidiary of NABARD, providing consultancy services in agriculture and rural development.

Sh. N. Vasudevan is a senior Indian Forest Officer of 1987 batch, currently serving as Additional Principal Chief Conservator of Forests, Research, Education and Training, Pune. Sh. Vasudevan holds dual Post-Graduate Degrees- in Marine Biology from Cochin University, and in 'Public Policy and Management' from I.I.M. Bangalore.

Prior to assuming the current responsibility, Sh. Vasudevan has been heading the 'Mangrove Cell' of Maharashtra, since its inception in 2012. He is responsible for many pioneering initiatives in the field of marine biodiversity conservation including the creation of the Thane Creek Flamingo Sanctuary, setting up of the Mangrove Foundation, introduction of many mangrove-based livelihood schemes and several programmes for conservation of endangered marine animals.

Sh. Vasudevan is the recipient of the Arun Bongirwar Award for Public Service Excellence (2019), Maharashtra Civil Services Day Honour (2017), Mangrove Society of India Fellowship (2016), Sanctuary Asia Special Maharashtra Wildlife Service Award (2015) and M.S. Swaminathan Foundation Special Award (1992). He has published two books and contributed several articles on mangroves and the coastal ecosystem.

Climate Change, Mangrove & Sustainable Management

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Title **Hidden Contribution of Shrimp Farm on Blue Carbon Dynamics**

Authors **Dr. Bambang Widigdo, Prof. Dr. Ir. Yusli Wardiatno, Dr. Ali Mashar M. Rifqi and Dr. Nyoto Santoso**

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Coastal shrimp pond is mostly constructed on mangrove area(Ilman et al., 2016). Many mangrove area were converted in to shrimp ponds. This condition has lead to the increase of blue carbon emission to atmosphere and contribute to climate change. Furthermore, climate change will influence negatively to shrimp farm such as reducing survival and growth rate of shrimp(Ahmed & Diana, 2015). Environmentally losing mangrove forest will influence blue carbon emission such as losing mangrove biomass(Alongi *et al.* 2015; Hilmi et al., 2017; Murdiyarso *et al.* 2015), reducing CO_2 sequestration(Heriyanto & Subiandono 2012; Rahman et al., 2017; Sondak 2015), released gas carbon that trapped in the soils of mangrove substrate(Alongi *et al.* 2015; Liu *et al.* 2014; Siikamäki et al., 2013).On the other hand, during shrimp culture operation, emission of CO_2 and CH_4 will potentially also increasing(Sidik & Lovelock, 2013; Rifqi et al., 2020a; Rifqi et al., 2020b). That is why brackish water shrimp farms considered to have negative impact on climate change. In this sense we want to explore positives site of shrimp farm in contributing environment through potentially to CO_2 adsorption(Geider & Osborne 1992; Baker 2004; Vallina et al., 2017), increasing carbon stock(Mitra & Zaman, 2015), and potential contribution for carbon donor(Hill et al., 2015).The research we have carried out aims to figure the flux of CO_2 and CH_4, and determine CO_2 adsorption and carbon stock from shrimp ponds which were operated extensively (traditional), semi intensively and intensively.

Method. Our research was conducted in April – July 2019 in BLUPPB, a shrimp farm development project installation belong to the government located in Karawang West Java. The research involved 9 ponds, 3 ponds for each extensive, semi intensive and intensive operation. The parameters monitored were: CO_2, CH_4, production primer, Chlorophyll-a, fuel consumption and production (shrimp

and fish), which were measured in 10 days interval during the shrimp culture cycle.

Result and Discussion. During the research were however not running smoothly, for farmers surrounding burned straw trash on the day of sampling. This influenced the data analyses especially on CO_2 emission. So some data should be eliminated.

Fluxes of carbon dioxide and methane. The daily maximum *carbon dioxide* flux form pond water was released by semi intensive operated ponds (350.14 mg $CO_2 m^{-2} day^{-1}$) and the minimum was released by intensive operated ponds (149.63 mg CO_2 m^{-2} day^{-1})(Rifqi et al., 2020b)**.** The daily methane flux from pond water was released by extensive operated ponds (0.63 mg CH_4 m^{-2} day^{-1}) and the minimum was by intensive operated ponds (0.22 mg CH_4 m^{-2} day^{-1})(Rifqi et al., 2020b).

Yearly emission of carbon dioxide and methane and global warming potential. The carbon dioxide emission was from two sources: from water as biological process and from energy consumption as fuel burning. Total yearly carbon dioxide emission maximum was found in intensive operated pond (91.59 ton CO_2 $ha^{-2}year^{-1}$) follow by semi intensive and extensive which was 66.39 and 0.97 ton CO_2 $ha^{-2}year^{-1}$respectively(Rifqi et al., 2020b). For the semi intensive and intensive operated ponds, the emission from electrical energy was significantly higher than from biological process. While those from extensive ponds was almost equal. Methane emission was only from ponds water as biological process and the maximum was found in extensive operated pond ($17x10^{-4}$ ton CH_4 $ha^{-2}year^{-1}$) followed by semi intensive and intensive operated pond was $0.7x10^{-4}$ and $0.5x10^{-4}$ ton CH_4 ha^{-2} $year^{-1}$(Rifqi et al., 2020b). Comparing the yearly maximum emission of carbon dioxide and methane from intensive operated pond with other common operation such as Paddy field (Masykur & Sudrajat, 2013;Hervani & Wiharjaka, 2014)and Peatl and Irrigation Channel Emissions (Setyanto et al., 2014; Hooijer et al., 2010) resulted that shrimp operation considered to be much lower. And if we further consider the potential contribution to global warming the intensive operated pond contribute the highest compare to two other operation method, but this was still much lower compare to paddy field and almost the same to peat land irrigation channel.

Carbon dioxide adsorption and carbon stock. The maximum daily carbon dioxide adsorption was found in intensive operated ponds and followed by semi intensive and extensive operated pond. Microalgae is potentially and effective for adsorbing CO_2,capturing, and store(Bhakta *et al.* 2015; Geider & Osborne 1992; Sayre, 2010;Moreira & Pires, 2016). (It is effective for capturing and adsorbing atmospheric CO_2 (Sayre, 2010;Moreira & Pires, 2016) Consequently, the

maximum carbon stock was also found in intensive and followed by semi intensive and extensive operated ponds**.** Microalgae have great biomass production (Mitra & Zaman, 2015),and applied as bio-mitigating (Moreira & Pires, 2016). (Algae have an efficient photosynthetic mechanism and high biomass production (Moreira & Pires, 2016). Microalgae develop rapidly with high biomass productivity. Microalga is a bio-mitigating organism (Moreira & Pires, 2016).

Yearly carbon dioxide adsorption and carbon stock. The total annual carbon dioxide adsorption and carbon stocks among the three shrimp culture technologies have the same sequence as the daily pattern. If we compare the yearly carbon dioxide adsorption and carbon stock, all technology of shrimp ponds were far below common mangrove(Hilmi et al., 2017; Rahman et al., 2017)**.**

Conclusion. The shrimp farm operation contributed to emission carbon dioxide and methane to the atmosphere. Most of carbon dioxide emissions come from energy consumption, to reduce these emissions it is necessary to find alternative energy sources that are low in emissions. Whereas to be able to reduce methane emissions can be pursued by increasing the efficiency and effectiveness use of feed and other inputs. (To minimize CO2 and CH4 emissions during shrimp culture, it is necessary to pay attention to these factors, as well as to the control and efficiency in the use of production inputs, including the management of pond wastewater.)The shrimp farm operation contributed positive to environment in the sense of adsorbing carbon dioxide and increasing carbon stock. For the environment protection and sustainability it is strongly recommended that construction of shrimp pond should outer of tidal area and not reducing mangrove areas.

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Author's Biography

Dr. Bambang Widigdo is an Associate Professor at Faculty of Fisheries and Marine Sciences, IPB University, Indonesia. He has obtained Engineer (Bachelor) Degree in Aquaculture from Faculty of Fisheries, IPB University, Indonesia in 1980 and Dr. Rer. Nat. in Biological Sciences from Ludwig Maximillion University,Munich, Germany in 1988. Soon after his returned from Germany in 1988 he held a research aiming to develop shrimp aquaculture technology on sandy area. This breakthrough technology was successfully commercialized in 1992, honored a paten from Ministry of Low and Human Right of Indonesian in 2003, and has national wide being implemented by several shrimp companies since 2000. He has been then doing several applicative research works focusing on sustainable shrimp farming. In 1996-2000 he has successfully improve the productivity of a 500 ha integrated shrimp farm project belong to government in Karawang, West Java. In 1998-2000 he has successfully developed and managed a 1,000 ha integrated shrimp farm in Seram Inlands, Indonesia, a joint venture project belongs to PT. Djajanti Group-Indonesia and Nippon Suisan - Japan. In 2003 – 2012 he was a Vice President for Integrated Quality Assurance in PT. Cental Proteina Prima -Charoen Pokphand Group Indonesia (an integrated shrimp industry, in Lampung – South Sumatra, Indonesia). His main tasks were among others to develop HACCP based Standard Operation Procedure (SOP) for Hatchery, Farm and Processing Plant, to full fill the international requirement for production sustainability, quality as well as food safety. His highest position in governmental institution was a Rector (President) at a State University, Borneo University of Tarakan (UBT), North Kalimantan 2013 – 2017. His main task was to lead the changes from private university management to governmental university management.

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title **Global distribution of crabs in mangrove forests**

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Brachyuran crabs are the most visible animal group in mangrove forest ecosystems. They are biologically diverse, abundant and rich in biomass, remarkably adapted to the fluctuating harsh conditions of the mangrove habitats. The mangrove crabs are distributed between land and sea in tropical and subtropical regions of the world. Species richness of the mangrove crabs is parallel to the mangrove tree species and the area of mangrove forest cover. The mangrove crabs are distributed in two global hemispheres namely, the Indo West Pacific region and Atlantic East Pacific region. The mangrove crab diversity is far greater in the former than that in the latter. We have recorded more than 400 species of crabs in the world mangroves. Among the mangrove-lined countries, India is represented with the highest diversity of 247 crab species. The diversity of crabs in mangrove habitats is due to microhabitat diversity of the mangroves ecosystems such as forest floor, trees, mud burrows, mudflats and water bodies. Fiddler crabs are the most abundant crabs in the mangroves. Mud crabs are typically associating with mangroves.

The crabs are “keystone” species, playing an important role in structure and function of mangrove ecosystems, through litter decomposition, trapping the energy within the mangroves, increasing the amount of nutrients, decreasing the sulfide in sediment, predating the mangrove seeds, serving as the food source for coastal fisheries, aerating the sediment by burrowing, modifying the substratum topography and grain size distribution, and creating the microhabitat for other fauna, contributing to secondary production. In short, it can be said “NO MANGROVES; NO CRABS’ revealing that the crab and mangrove association is obligatory for many species in providing food, calm shelter, breeding and nursery grounds for the crabs by the mangroves.

Crabs are the “ecological engineers” in the mangrove ecosystems. They plough

the anaerobic soil, increase aeration and fluxing by tidal water, reduce the levels of toxic ammonia and sulphides thereby increasing microbial colonization that supports benthic organisms. The crab construct burrows for breeding, foraging and protection from predators, desiccation tolerance, storing and processing of mangrove leaf litter for leaching toxic phenols and encouraging the microbial colonization thereby making the decomposing organic matter rich in nutrients. The burrow structure varies with crab species.

In addition to ecological significance, the mangrove crabs such as mud crabs are commercially valuable for human consumption. Hence, aqua-farming of the mud crabs is becoming revenue-generating livelihood and also community adaptation to climate change. However, most the marine crab species especially mangrove crabs have not been assessed for IUCN red-listing due to data-deficiency on the distribution of the mangrove crabs, and this aspect deserves much more focus in the future.

Author's Biography

Dr.Wah Wah Min achieved B.Sc., MSc and Ph.D degrees in Zoology in the years 1998, 2001 and 2009 respectively from Myanmar. Her main qualification includes ecology, entomology and environmental science. She implemented two research projects with financial support of Government of Myanmar. She has seven international publications to her credit. She undertook an international training course on 'Mangrove Biodiversity and Ecosystems' with the support of United Nation University, Canada for two weeks. Dr. Min has been working as a researcher on carbon sequestration in mangrove under supervision of Professor K. Kathiresan, the former dean and director of the Centre of Advanced Study in Marine Biology, Annamalai University, India for six months (August 2016-January 2017) with the support of India Science and Research fellowship. In addition, she has attended many international training courses and conference in India. She went to School of Engineering and Resources at Wailailak University, Thailand as a visiting scholar in 2017 and 2018 for giving lecture to undergraduate students and then has presented as oral presenter in Asean 50 mangrove congress, 2017 Philippines and China on APISE 2018 Conference Program, 2nd International Conference on Environmental and Energy Engineering (IC3E,2018), Xiamen University of Technology, and attended on "The fourth international workshop on the Science and the conservation of horseshoe crabs" in Qinzhou,2019, China.

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Ecological and Economic Services of Mangroves

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Abstract

Mangrove is one of the rich and underexploited ecosystems, which consist of taxonomically varied members, dispersed along tropical and sub-tropical environments having definite habitats. Mangrove forests are considered as a particularly significant ecosystem, as it inhabits a large range of fauna, which totally depends on this coastal ecosystem for their survivor. Mangroves also got human attention due to their provision of services like timber and fuel wood, fisheries, coastal defence, and pharmaceutical values. Furthermore they also afford about US $1.6 billion each year in ecosystem services. The present work aims to highlight the ecological and economic services of mangroves based on published reports.

Poster

Climate Change, Mangrove & Sustainable Management

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Title

Mangrove Ecosystem

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Abstract

Mangroves are trees that live along tropical coastlines, rooted in salty sediments, often underwater. Like sea grasses, mangroves are flowering plants, but unlike sea grasses, most of the plant lives above water. The upper trunk and all of the branches and leaves of a mangrove tree live completely above the water line, while the lower trunk and the very large system of aboveground roots are often covered by seawater. Each and every terms of utilization in the mangrove ecosystems leads to destruction of their community, leads to several negative impacts in the ecological and environmental facets. As a better promotion and conservation of the mangrove species, in vitro cultivation and propagation might conserve the loss of mangroves from their natural habitat. Mangrove conservation efforts are largely aimed at preventing destruction of mangrove ecosystems, and increasing coverage. A key issue is not just destruction but degradation of mangrove ecosystems, through pollution, siltation, and changes in salinity or loss of biodiversity.

Poster

Mangroves are distributed to the lower latitude (32 degrees S - 3 degrees N) in the tropical regions. The maximum diversity and area cover lies in the regions between 25 degrees S - 25 degrees N. These habitats are ecologically productive and are of socio-economic importance. They play a significant role in the sedimentation helping in the land building process, and also protect the same by reducing erosion with the help of their specialised root network. It harbours various kinds of organisms including some of commercial importance. Mangrove regions being rich in detritus (organic matter), serve as a natural nursery for a variety of fishes and shellfishes, and hence are used for aquaculture practices. In spite of their importance, these valuable natural resource of the world are declining rapidly due to their over-exploitation for immediate commercial gains. India has a coastline of about 6,500 km along the mainland. In addition, it also has the coastline of the Andaman and Nicobar and Lakshadweep groups of islands in the Bay of Bengal and the Arabian Sea respectively. Coastal wetlands area of about 63,600 sq km in the country hardly includes about 5% of mangrove cover. Due to unawareness regarding the importance and lack of management in the past has caused enormous damage to the mangrove habitats in the country.

MANGROVE ECOSYSTEM

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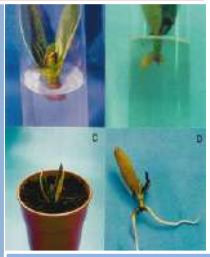
INTRODUCTION

Mangroves are trees that live along tropical coastlines, rooted in salty sediments, often underwater. Like seagrasses, mangroves are flowering plants, but unlike seagrasses, most of the plant lives above water. The upper trunk and all of the branches and leaves of a mangrove tree live completely above the water line, while the lower trunk and the very large system of aboveground roots (called prop roots) are often covered by sea water.

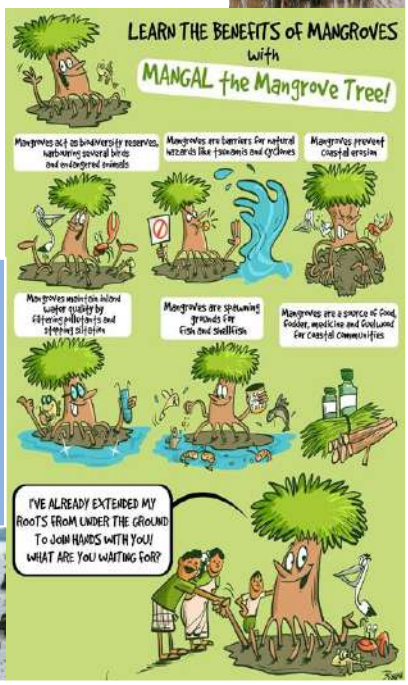
INVITRO CULTIVATION OF MANGROVE TREES

Each and every terms of utilization in the mangrove ecosystems leads to destruction of their community, leads to several negative impacts in the ecological and environmental facets. As a better promotion and conservation of the mangrove species, *in vitro* cultivation and propagation might conserve the loss of mangroves from their natural habitat. If the callus induction of the mangrove species were successfully cultured, there is dire need for production of the secondary metabolites and their potential. By this propagation and conservation tremendous purpose of commercial and medicinal need must be satisfied. Even now there may be lack of success rate for better *in vitro* culture of mangrove species, but we hope the advanced research may move towards the conservation of mangrove through *in vitro cultures.*



CONCLUSION

Mangrove conservation efforts are largely aimed at preventing destruction of **mangrove** ecosystems, and increasing coverage. A key issue is not just destruction but degradation of **mangrove** ecosystems, through pollution, siltation, changes in salinity or loss of biodiversity.



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Mumbai's Vanishing Mangroves: An Alarming Situation

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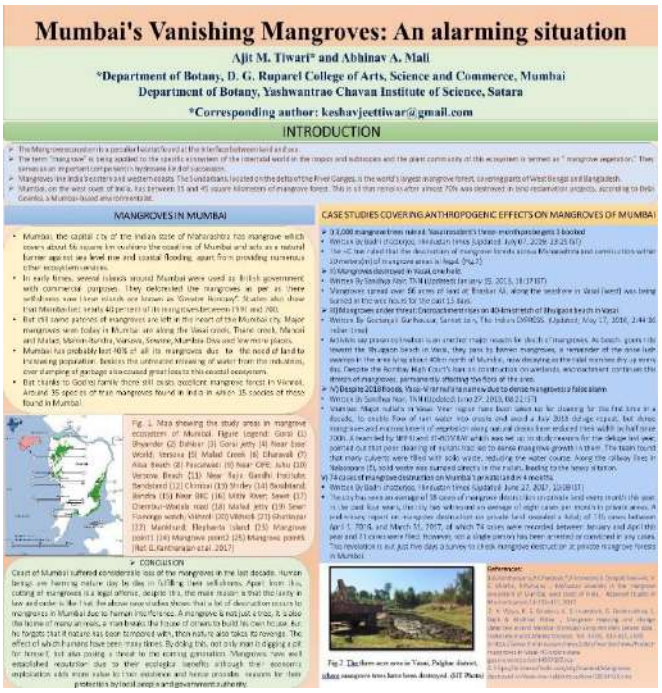
Abstract

Mangroves are one among the most productive and biologically important ecosystem on this planet providing vital ecosystem goods and services. As per the ISFR 2017 report, the total area of mangrove cover of India is 4921 km2 which contributes 3.3% to the global mangrove cover, in which Mumbai covers 50 km2. area. Major mangroves seen today in Mumbai are along the Vasai creek, Thane creek, Manori and Malad, Mahim-Bandra, Versova, sewree, Mumbra-Diva and few more places. In India, today's reduction in mangrove population is a typical example of detrimental effects of anthoprogenic activities to nature. Mumbai has probably lost 40% of all its mangroves in past decade or so, largely because of reclamation for housing, slums, sewage treatment and garbage dumps. Due to the uniqueness of mangroves ecosystem and their benefits to coastal communities, they are an object in conservation programs including national biodiversity action plan. The proposed work is based on several published research papers and news articles about Mumbai's mangroves, which had enlightened devastating loss of mangroves the need of their conservation.

Poster



Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Mangroves Support Biodiversity and Fish Nurseries, Reduce Erosion,Protect Coasts, Regulate The Climate and Provide Resources

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Abstract

Trees are essential for local and global climate, they regulate temperature by creating shade and increase rainfall by storing and releasing water vapour, Mangroves are extremely effective at storing carbon in their leaves' wood and roots as well as the sediments they hold in place. This helps protect the planet from climate change. Trees enable us to breathe by absorbing carbon dioxide from the air and releasing oxygen that all living all things need to survive. Mangroves can provide wood for building and fuel for cooking. Some mangrove roots and fruits are also used in traditional medicine. It is crucial they are harvested sustainably. Mangroves protect the coast from erosion by reducing the flow of sol and sediment from the land into the sea. This water filtration helps protect offshore ecosystems such as coral reefs. Mangroves also reduce the impact of waves on the shore. This is increasingly important with the threat of rising sea levels and extreme weather due to climate change. Mangroves provide food and she litter from many species above and below the water. They are important nurseries for fish and crustaceans and support a huge variety of birds. Mollusks and crabs. They provide monkey which is found nowhere else in the world. Mangroves protect coastal land and waters. This ensures the survival of many species, including those that provided food and income for communities. Mangroves sustain fisheries and coastal crops as well as providing opportunities for ecotourism. By protecting trees you are protections your family. Your food, your health and your wealth. WCS works to protect Tanzania's mangroves and forests so that their unique biodiversity survives and people benefit from their natural environment.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Mangroves: The Backbone of Ecosystems

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Abstract

Mangroves, known as one of the most diverse Ecosystem, form an Ecotone between Marine & Terrestrial Ecosystems. They are mainly Halophytic vegetation, widely known for Pneumatophores (Breathing roots) and the Viviparous germination. The Mangroves are credited for trivial Medicines, role as Tsunami breakers & Carbon sequestration capability. Though Mangroves are threatened due to Climate change, Global warming & other anthropogenic causes, they can be brought to full-fledged life through Rehabilitation projects, Special Mangrove reserves & buffers.

Climate Change, Mangrove & Sustainable Management

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Title

Mangrove Resources

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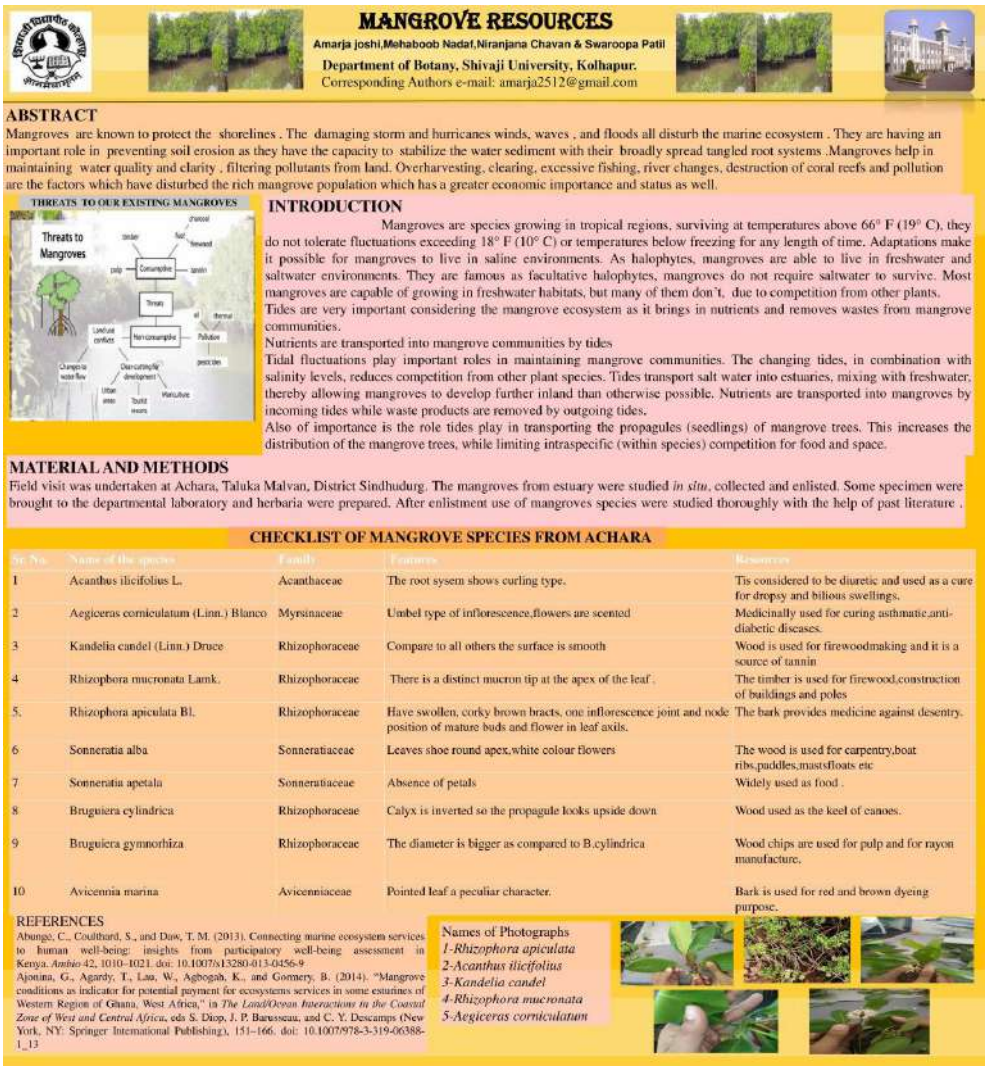
Abstract

Mangroves are known to protect the shorelines. The damaging storm and hurricanes winds, waves, and floods all disturb the marine ecosystem. They are having an important role in preventing soil erosion as they have the capacity to stabilize the water sediment with their broadly spread tangled root systems .Mangroves help in maintaining water quality and clarity , filtering pollutants from land. Overharvesting, clearing, excessive fishing, river changes, destruction of coral reefs and pollution are the factors which have disturbed the rich mangrove population which has a greater economic importance and status as well.

Poster



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Aerosol Characterization Over Mangrove Forest Region In India: A Review

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Abstract

Aerosols originated from the surf zone at the land-ocean boundary of Sundarban mangrove forest and categorized in terms of major water soluble inorganic species. Major chloride depletion from sea-salt aerosols was detected in coarse and ultrafine mode associated to fine mode in winter although reverse trend was detected during summer. On a usual the chloride to sodium ratio in PM10 aerosol was found to be around 0.6 which was considerable than that in sea-water. It was detected that non-sea-sulphate and nitrate aerosols were the major species depleting chloride from sea-salt aerosols. This reinforced the interaction between fresh marine and polluted anthropogenic aerosols. The average concentration of PM10 aerosols was 64 µgm-3 in winter and 89 µgm-3 in summer. Major water soluble ionic species were used for the source apportionment of aerosol during the two seasons. On an average it was observed that 60-70 % of total PM10 aerosols were constituted by the major water soluble ionic species. Emission flux and deposition flux of aerosols were also studied over this remote forest region. Overall, underneath the impact of continental polluted air mass was found to influence the pristine marine air quality over this ecologically important region. The annual mean aerosol concentrations in the coarse, accumulation and nucleation modes were found to be 61.49 ± 22.32, 40.51 ± 13.19, 7.14 ± 4.9 µgm−3. The SO4−2/Cl− ratio in the marine aerosol collected from Sundarban mangrove ecosystem was significantly greater than that of the seawater.

Poster

Climate Change, Mangrove & Sustainable Management
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Title

Assessment of Coastal Blue Carbon From The Mangroves of Greater Mumbai

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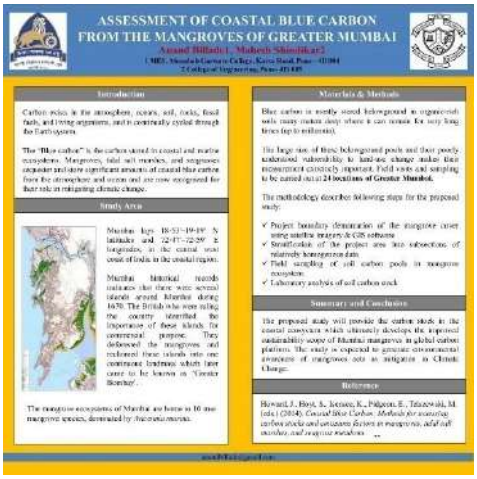
Abstract

Carbon exists in the atmosphere, oceans, soil, rocks, fossil fuels, and living organisms, and is continually cycled through the Earth system. The "Blue carbon" is the carbon stored in coastal and marine ecosystems. Mangroves, tidal salt marshes, and seagrasses sequester and store significant amounts of coastal blue carbon from the atmosphere and ocean and are now recognized for their role in mitigating climate change. Mumbai lays 18◦53′–19◦19′ N latitudes and 72◦47′–72◦59′ E longitudes, in the central west coast of India in the coastal region. The mangrove ecosystems of Mumbai are home to 10 true mangrove species, dominated by *Avicennia marina*. Blue carbon is mostly stored belowground in organic-rich soils many meters deep where it can remain for very long times (up to millennia). The large size of these belowground pools and their poorly understood vulnerability to land-use change makes their measurement extremely important. Field visits and sampling to be carried out at 24 locations of Greater Mumbai. The methodology adopted for the proposed study have been taken from the Howard, J., Hoyt, S., Isensee, K., Pidgeon, E., Telszewski, M. (eds.) (2014). Coastal Blue Carbon: Methods for assessing carbon stocks and emissions factors in mangroves, tidal salt marshes, and seagrass meadows. The proposed study will provide the carbon stock in the coastal ecosystem which ultimately develops the improved sustainability scope of Mumbai mangroves in global carbon platform. The study is expected to generate environmental awareness of mangroves acts as mitigation in Climate Change.

Poster



Climate Change, Mangrove & Sustainable Management
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Title

Status of Mangroves in India – A Review

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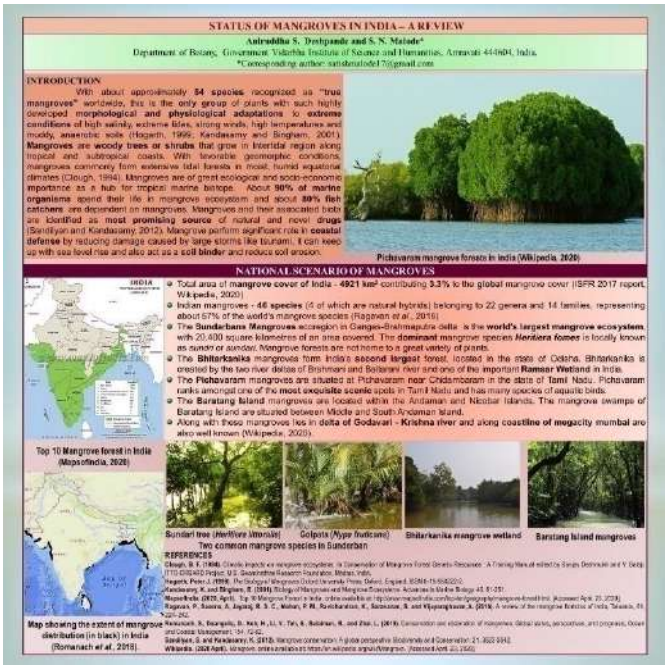
Abstract

With about approximately 54 species recognized as “true mangroves” worldwide, this is the only group of plants with such highly developed morphological and physiological adaptations to extreme conditions of high salinity, extreme tides, strong winds, high temperatures and muddy, anaerobic soils etc. Total area of mangrove cover of India is about 4921 km2 contributing 3.3% to the global mangrove cover. Indian mangroves consist of 46 species representing about 57% of the world's mangrove species. Among mangrove ecoregion in India, Sundarbans Mangroves ecoregion in Ganges-Brahmaputra delta is the world's largest mangrove ecosystem, having Heritierafomes as dominant mangrove species locally known as sundri or sundari. Second largest mangrove forest is Bhitarkanika mangroves located in the state of Odisha. It is one of the important Ramsar wetland in India. The Pichavaram mangroves situated in the state of Tamil Nadu ranks amongst one of the most exquisite scenic spots and have many species of aquatic birds. Another mangrove island located within the Andaman and Nicobar Islands is the Baratang Island situated between Middle and South Andaman Island. Along with these, mangroves lies in delta of Godavari - Krishna river and along coastline of megacity Mumbai are also well known.

Poster



Climate Change, Mangrove & Sustainable Management
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Title

Service of Mangroves for the Benefit of People and Ecosystem

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Abstract

The mangrove ecosystem is a very important coastal ecosystem in India. India's rich coastline, spanning across 7,500 km in 13 maritime mainland states and union territories, supports coastal and marine ecosystems that are rich in biodiversity. In India, mangrove forests have a long history of being one of the most biologically-rich regions. Mangroves are a part of these ecosystems. Mangroves have special adaptations against the hard environmental conditions. Mangrove forest provides many services to a people. The goods and services provided by natural ecosystems contribute to human well-being, both directly and indirectly. Peoples live on coastal areas that use mangroves and their resources. It may be considerable botanical and ecological knowledgeable about these forests. A wide variety of forest products are harvested in mangroves, especially wood for fuel and construction, tannins, medicines and charcoal. Mangroves provide to local fisheries and also provide critical nursery habitat and marine productivity which support wider commercial fisheries. These forests also provide valuable ecosystem services that benefit coastal communities, including coastal land stabilization and storm protection. Community peoples to aware how to conserve mangroves through national policies and afforastation.

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Diversity of Mangroves from Goa, West Coast of India

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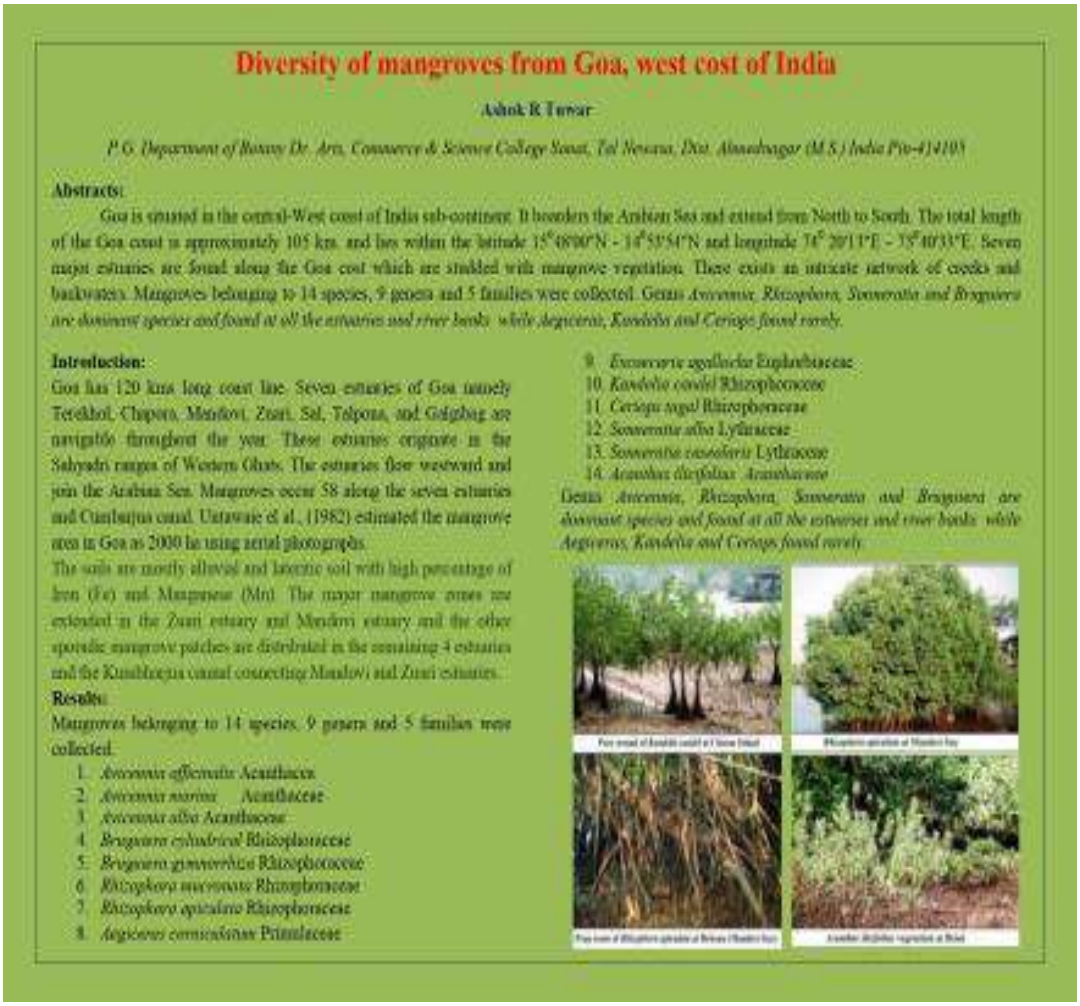
Abstract

Goa is situated in the central-West coast of Indian sub-continent. it borders the Arabian Sea and extends from North to South. The total length of the Goa coast is approximately 105 km and lies within the latitude 15°48'00"N - 14°53'54"N and longitude 74°20'13" E – 73°40'33"E. Seven major estuaries are found along the Goa coast which are studded with mangrove vegetation. There exists an intricate network of creeks and backwaters. Mangroves belonging to 14 species, 9 genera and 5 families were collected. Genus Avicennia, Rhizophora, Sonneratia and Bruguiera are dominant species and found at all the estuaries and river banks whileAegiceras, Kandelia and Ceriops found rarely.

Poster



Diversity of mangroves from Goa, west cost of India

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Abstracts:

Goa is situated in the central-West coast of India sub-continent. It borders the Arabian Sea and extend from North to South. The total length of the Goa coast is approximately 105 km. and lies within the latitude 15°48'00"N - 14°53'54"N and longitude 74° 20'13"E - 73°40'33"E. Seven major estuaries are found along the Goa cost which are studded with mangrove vegetation. There exists an intricate network of creeks and backwaters. Mangroves belonging to 14 species, 9 genera and 5 families were collected. Genus *Avicennia, Rhizophora, Sonneratia and Bruguiera are dominant species and found at all the estuaries and river banks while Aegiceras, Kandelia and Ceriops found rarely.*

Introduction:

Goa has 120 kms long coast line. Seven estuaries of Goa namely Terekhol, Chapora, Mandovi, Zuari, Sal, Talpona, and Galgibag are navigable throughout the year. These estuaries originate in the Sahyadri ranges of Western Ghats. The estuaries flow westward and join the Arabian Sea. Mangroves occur 58 along the seven estuaries and Cumbarjua canal. Untawale et al., (1982) estimated the mangrove area in Goa as 2000 ha using aerial photographs.

The soils are mostly alluvial and laterite soil with high percentage of Iron (Fe) and Manganese (Mn). The major mangrove zones are extended in the Zuari estuary and Mandovi estuary and the other sporadic mangrove patches are distributed in the remaining 4 estuaries and the Kumbharjua canal connecting Mandovi and Zuari estuaries.

Results:

Mangroves belonging to 14 species, 9 genera and 5 families were collected.

1. *Avicennia officinalis* Acanthacea
2. *Avicennia marina* Acanthacea
3. *Avicennia alba* Acanthacea
4. *Bruguiera cylindrical* Rhizophoraceae
5. *Bruguiera gymnorrhiza* Rhizophoraceae
6. *Rhizophora mucronata* Rhizophoraceae
7. *Rhizophora apiculata* Rhizophoraceae
8. *Aegiceras corniculatum* Primulaceae
9. *Excoecaria agallocha* Euphorbiaceae
10. *Kandelia candel* Rhizophoraceae
11. *Ceriops tagal* Rhizophoraceae
12. *Sonneratia alba* Lythraceae
13. *Sonneratia caseolaris* Lythraceae
14. *Acanthus ilicifolius* Acanthaceae

Genus *Avicennia, Rhizophora, Sonneratia and Bruguiera are dominant species and found at all the estuaries and river banks while Aegiceras, Kandelia and Ceriops found rarely.*

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Antifoliary Activity of Gold Nanoparticles Against *Rhizophora apiculata* Saplings

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Abstract

Application of safe nano-coating has become a topic of great interest in the field of bio-nanotechnology because of their potential for increased shelf life of many bio-based products. The present study investigated the synthesis of gold nanoparticles and its antifoliary activity against *Rhizophora apiculata* saplings. The gold nanoparticles sprayed in the *Rhizophora* saplings showed good antifoliary activity against the leaf eating insects as well as growth enhancement of the saplings. In the present study, after 30 days of monitoring, the nanoparticle increased the shelf life of treated plants when compared to control with respect to height, internodal difference, leaf area and number of leaves. This study highlighted the possibility of using gold nanoparticles as an antifoliar agent to prevent medicinal, endangered and rare plants of coastal origin

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Threats to Mangrove

Authors **Dr. Bhaurav Tukaram Dangat**
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Abstract

Mangroves are one of the most threatened ecosystems worldwide located within the intertidal zones of tropics and subtropics. They provide both ecologic and economic benefits to coastal communities. They safeguard community lives and properties in coastal areas during storm surges, hurricanes, cyclones and tsunamis. Global estimate shows decline in mangrove vegetal covers to ~150,000 sq. km. Degradation of mangrove ecosystems in India are mainly due to biotic and abiotic factors such as continuous increase in anthropogenic activities viz. conversion of mangrove wetlands for aquaculture and destruction of mangrove forest for timber. In the coastal areas inhabitants are at risks of losing their livelihood and ecological communities are in the verge of extinction. The effective conservation and management of mangrove habitats should be considered in association with local community participation and application of remote sensing technique and Geographic Information System (GIS)-based comprehensive database approach. Current paper deals with various biotic and abiotic threats to mangrove ecosystem in India.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Mangrove Ecosystem: A Biological Basis for Sustainable Development

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Abstract

Mangroves are the important ecosystem of coast constituting habitats for different floral and faunal components. They are distributed in the intertidal region between sea and land. This group of plants forms unique habitat forming vegetation in the estuarine region. They are extremely important to coastal societies for both livelihood and commercial purpose. A mangrove are most productive ecosystem on earth, providing wide range of valuable products, maintain estuarine water quality and plays a vital role in the life cycle of many fish and shellfish. Mangroves are distributed in about 112 countries with total area about 18 million hectares. In India mangroves are distributed in about 4628 Sq. Km. constituting about 8% of total Indian coastline while in Maharashtra mangroves covers an area about 186 Sq. Km. The services of mangrove ecosystem are essential for the sustainable development of biodiversity as well as coastal protection, fishery resources etc. Mangroves, sea grass beds, and coral reefs work as a single system that keeps coastal zones healthy. Mangroves provide essential habitat for thousands of species. They also stabilize shorelines, preventing erosion and protecting the land and the people who live there from waves and storms. Mangrove habitats are destroying at an alarming rate, due to direct anthropogenic activities and global change. Climate change is likely to have a considerable impact on mangrove ecosystem like increase in extreme weather events, rise in sea level, increase in temperature of sea surface, ocean acidification etc. The trees trap sediment and pollutants that would otherwise flow out to sea. Sea grass beds provide a further barrier to silt and mud that could smother the reefs. In return, the reefs protect the sea grass beds and mangroves from strong ocean waves. Without mangroves, this incredibly productive ecosystem would collapse.

Climate Change, Mangrove & Sustainable Management
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Title

Bio-diversity and its Conservation

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Abstract

Biodiversity of an ecosystem is a vital issue of an economy. Soil, water, Climatic Condition, forest cover and biodiversity are crucial in determining the renewable resource flow of an economy. Sustainable development stresses on economic development along with the object of conservation of environment. The loss of biological diversity is a global crisis. "Biological diversity" is defined as "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. Various taxonomists and conservationist in their study find out that estimation and nomenclature of known species found on earth is a very hard work. But there are few organisms which have nearly complete information about their species, total numbers for e.g. Birds and Higher Plants. A look at worlds' biological resources. Eight countries retain their original forest; Brazil, Canada and Russia account for 2/3 of global original forest tracts, 76 countries have lost their original forests completely 28 countries including India are loosing original virgin forests and face severe threat of ecological imbalance if conservation efforts are not taken urgently. Mega biodiversity regions Mexico, Columbia, Equador, Peru, Brazil, Zaire, Medagascar, China, India, Malaysia, Indonesia, Australia. .Biodiversity and its benefits Agriculture Functioning ecosystem .Economic value- extractable products, fuels, medicines, materials for shelter, food and energy. Compounds, genes & species for industry. Ecosystems- climate regulation, hydrological and chemical cycles in soils .Recreation- social, ethical, spiritual, cultural and economic goods and services.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Save Mangroves, Save Nature

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Abstract

Mangroves are biodiversity hotspots. Mangroves forests are extremely providing critical productive ecosystems services that benefit all of us. Mangroves forests were once generally dismissed as swampy wastelands.Mangroves provides essential habitat for thousand of species. They also stabilize shorelines preventing erosion and protecting the land and the people who live there from waves and storms. Without mangroves this incredibly productive eco-systems would collapse.Mangroves provide ideal breeding grounds for much of the world's fish shrimp crabs and other shell fish. An estimated 75% of commercially caught fish spend sometimes in the mangroves or depend on food webs that can be traced back to these coastal forests. The tons of leaves that full from each acre of mangrove forests every year are the basis of an incredibly productive food web.Mangroves protect both the salt water and fresh water ecosystems. They are extremely productive ecosystems. Healthy mangrove ecosystem means healthy fisheries from which to fish and healthy land on which to farm.Mangroves are essential to maintaining water quality. With their dense network of roots and surroundings vegetation they fitter and trap sediments heavy metals and other pollutants. Mangroves are the only species of the trees in the world that can tolerant salt water.Mangroves "sequester carbon at a rate 2 to 4 times to greater than mature topical forests and shore 3 to 5 times more than carbon per equivalent area than tropical forests like the Amazon rain forests".Mangroves are essential to fighting climate changes the warming of the global climate fueled by increased carbon emissions that is already having disastrous effects on the communitiesworld wide.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Biodiversity and Conservation of Mangrove Ecosystem

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Abstract

Biodiversity, as its name suggests, is a diversified way of encircling variety of life forms on our planet, from a single level of organization till the biosphere. It generally acknowledges the assortment of existing lives on basis of taxonomy, function, phylogeny, tropic or genes. Biodiversity is a mixture of species and functional oriented things whereas ecosystem encompasses biomass. Further, the verity of an ecosystem comprising biotic diversity involves forest, grassland, desert, tundra, freshwater and marine ecosystem. They are also known as coastal rainforest, tidal forest or coastal woodland. There are about 1, 59, 041.5 km2 of mangrove forests which are less than 1% of all tropical forest throughout the world, and less than 0.4% of the total global forest estate.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Restoration and Management of Mangrove Ecosystem

Authors **Chirag Narayankar, Sudarshan Charaplae, Vilas Patil, Dr. Ahilya Waghmode and Dr. D.K Gaikwad**

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Abstract

Mangroves are exceptional ecosystem found along the coastline of the tropics and subtropics. There are near about 50 to 70 known mangrove species through the worldwide which are directly beneficial to humans. Nowadays Mangroves are undergoing in decline on all the four continents where they are found. So for the conservation of Mangrove i.e Community-based Ecological Mangrove Restoration (CBEMR) is a holistic, effective, eco-friendly and natural to restore the diversity and functionality of mangrove ecosystem.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Mangrove Ecosystem Services and Threats

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Abstract

Mangroves are in risk biome whose protection and restoration through payments for ecosystem services (PES) can contribute to improved livelihoods, climate mitigation and adaptation. Fish and nursery habitat and storm protection were widely recognized and highly valued mangrove ecosystem services. The importance placed on mangrove services did not differ significantly by village, religious denomination, gender, age, income, education or occupation. Mangrove ecosystem surveys are useful as tools for raising community awareness and input prior to design of PES systems.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Spiders as Bio-Indicators of Anthropogenic Stress in Natural and Semi-Natural Habitats in Umarkhed Area of Yavatmal District: Some Recent Developments

Authors **Dr. Dinesh K. Dabhadkar and Dr. Nitin M. Raut**

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Abstract

Spiders have been extensively used as ecological indicators in nature conservation and management in forest nearby area of Umarkhed taluka. Recently, biodiversity survey has been set up to assess the effects of habitat fragmentation on spider populations. From the first results of these studies, it seems that spiders could be good bio-indicators for evaluating the impact of these anthropogenic disturbance factors on natural ecosystems. Transact were form and photography was carried out. The spiders were identified by various key methods. In conclusion it was found that the spiders being our mobile generalist predators are more likely to influence by seasonal changes. Vegetation structure of the forest stands proved to be the most influential factor of spider species diversity and richness. Spiders act as bio-indicators in the forest ecosystem.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Adaptations for Salinity Tolerance in Mangroves

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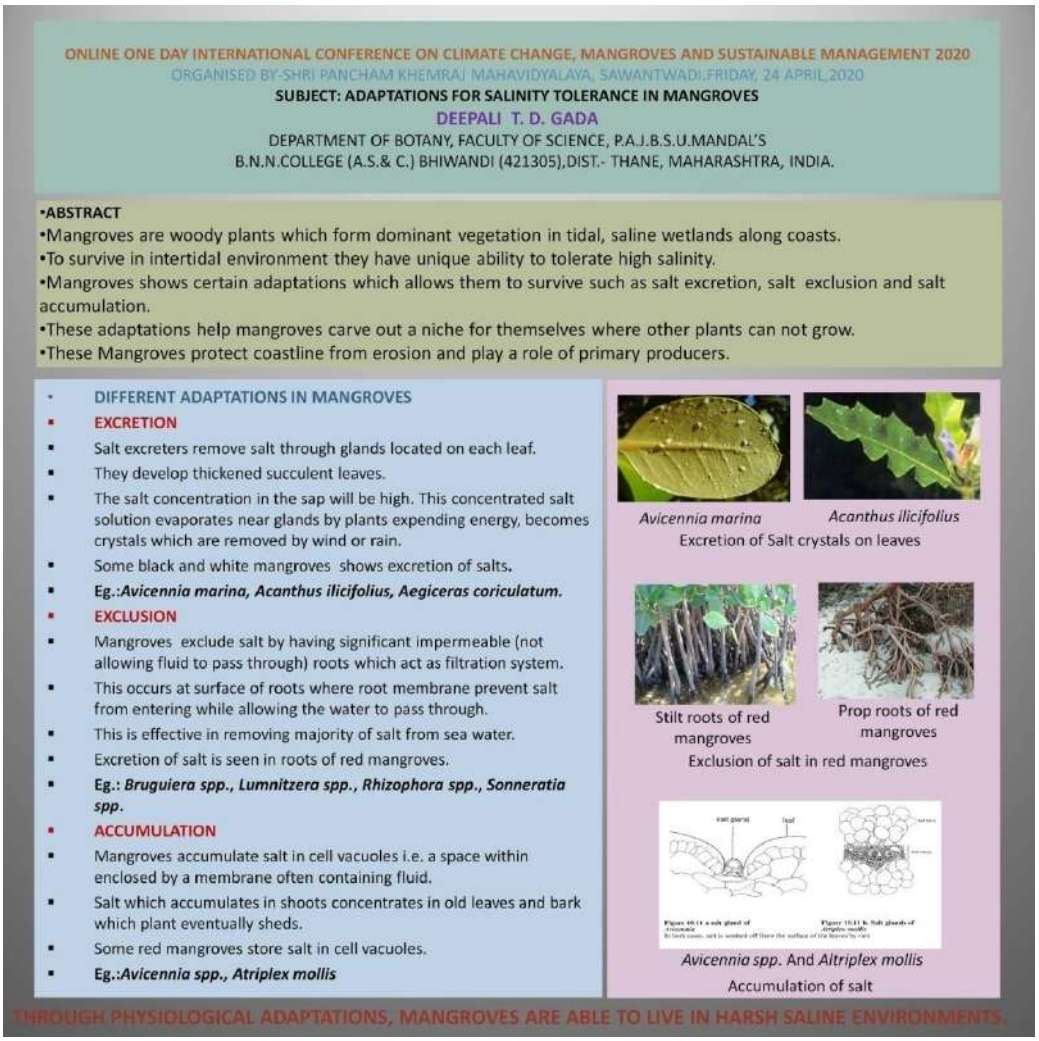
Abstract

Mangroves are woody plants which form dominant vegetation in tidal, saline wetlands along coasts.To survive in intertidal environment they have unique ability to tolerate high salinity.Mangroves shows certain adaptations which allows them to survive such as salt excretion, salt exclusion and salt accumulation.These adaptations help mangroves carve out a niche for themselves where other plants cannot grow.These Mangroves protect coastline from erosion and play a role of primary producers.

Poster



Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Significance of Mangroves

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Abstract

Mangroves are salt tolerant, woody plants that grow along tidal estuaries, in salt marshes and on muddy coasts. They have unique adaptations such as prop roots, pneumatophores and viviparous seeds. Mangrove flora consists of species of *Rhizophora, Avicennia, Sonneratia, Bruguiera, Kandelia*. Many species exhibit immense ecological and economical benefits. They provide habitat for thousands of species at all levels of marine and forest food webs. Mangrove forests serve as valuable nursery areas for fishes and invertebrates. They also support a number of threatened and endangered species. They protect shorelines from damaging storm and hurricane winds, waves, and floods. The dense root systems of these forests prevent erosion by stabilizing sediments. They filter and assimilate pollutants from upland run-off, thereby improving the water quality. People have globally utilised mangrove trees as renewable resources. Fisheries in these areas form an essential source of food for numerous coastal communities around the world. Use of mangroves for tourism has led to great potential for revenue generation. Owing to this significance, mangroves have become one of the world's most threatened tropical ecosystems mainly due to clearing, overharvesting, pollution, global warming, river variations and tourism. Hence, various strategies are adopted for their conservation such as afforestation, legislation, monitoring and surveys, protection with parks and reserves development and sustainable management. Future research can be carried out globally to conserve mangrove forests.

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Mangrove biodiversity and threats; Location: Bhandup Pumping Station, Airoli, Mumbai, India.

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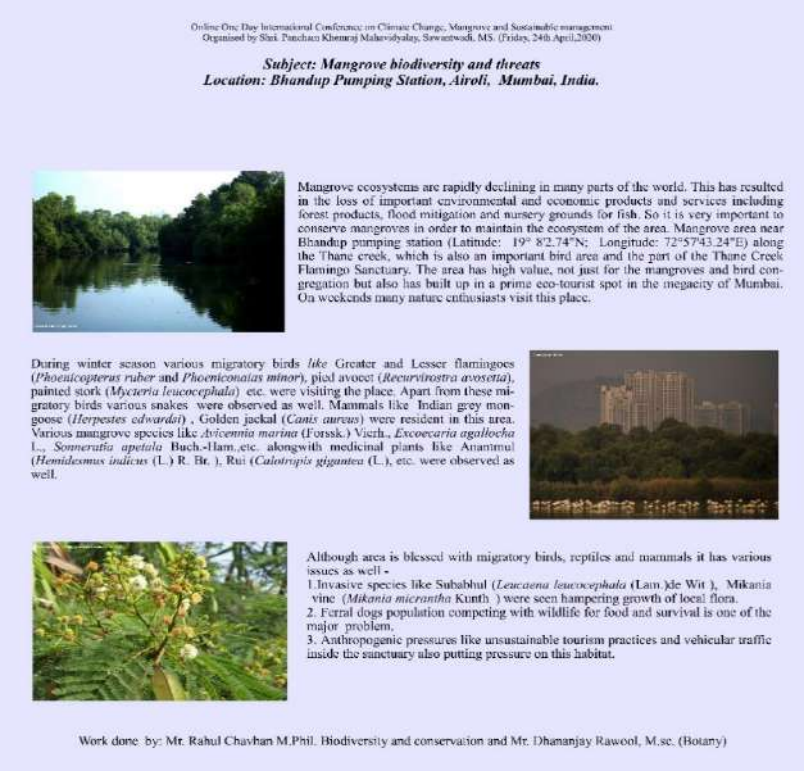
Abstract

Mangrove ecosystems are rapidly declining in many parts of the world. This has resulted in the loss of important environmental and economic products and services including forest products, flood mitigation and nursery grounds for fish. Mangrove area near Bhandup pumping station along the Thane creek is also an important bird area and the part of the Thane Creek Flamingo Sanctuary. The area has high value, not just for the mangroves and bird congregation but also has built up in a prime eco-tourist spot in the megacity of Mumbai. On weekends many nature enthusiasts visit this place.In winter season various migratory birds visiting the place, apart from birds various snakes, mammals, and many mangroves species can be observed here along with native and exotic flora. As area falls within the city limits invasive species of flora and fauna, Anthropogenic pressures like unsustainable tourism practices and vehicular traffic putting pressure on this habitat.

Poster



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Mangrove the Most Productive Ecosystem on the Planet

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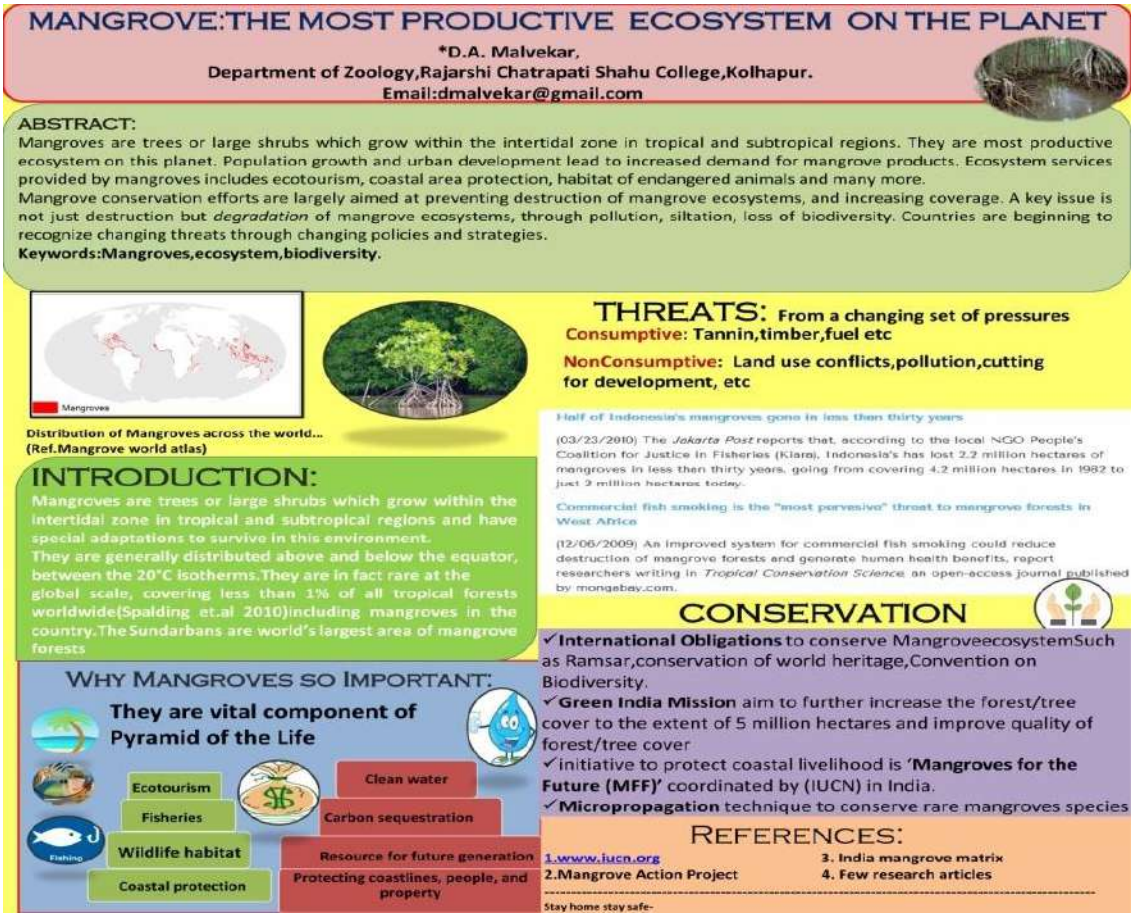
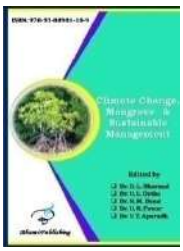
Abstract

Mangroves are trees or large shrubs which grow within the intertidal zone in tropical and subtropical regions. They are most productive ecosystem on this planet. Population growth and urban development lead to increased demand for mangrove products. Ecosystem services provided by mangroves includes ecotourism, coastal area protection, habitat of endangered animals and many more.Mangrove conservation efforts are largely aimed at preventing destruction of mangrove ecosystems, and increasing coverage. A key issue is not just destruction but degradation of mangrove ecosystems, through pollution, siltation, loss of biodiversity. Countries are beginning to recognize changing threats through changing policies and strategies.

Poster





Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Mangrove Vegetation in India

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Abstract

Mangroves are basically halophytes and are adapted in coastal saline, marshy habitats. The total mangrove forest covered area of the world is 137760 Km2. It spread in over118 countries and territories in the tropical and sub-tropical regions of the world. Total mangrove cover in India is 4975 Km2 as reported by Indian Survey of Forest Research (ISFR, 2019) which is 0.15% of the country's total geographical area. ENVIS Centre of Floral Diversity reported that, Indian mangrove ecosystems constitute a large number of floral and faunal wealth. Mangrove forests are one of the biodiversity hot spots. More than 1600 plants and 3700 animal species have been identified. Floral elements comprises true mangroves, associated plant species, vines, lianas, lilies, orchids, ferns, sea grasses, sea weeds, algae, phytoplanktons, lichens, fungi, actinomycetes and bacteria. Out of 101 species of true mangroves recorded from world, 71 are reported to be present in India. Some common mangroves reported are as follows – *Rhizophora, Avicennia, Bruguiera, Ceriops, Sonneratia, Heritiera, Laguncularia, Aegiceras, Acanthus, Conocarpus* and *Nypa* with different species (Ghosh, 2011). Mangrove forests act as coastal stabilizers, as breeding habitat, shelter belt areas, barrier of the sea erosion, nutrient export zone, as foundation in a complex marine food chain, beneficial in carbon sequestration etc. They are eco-friendly, benefit the coastal ecology and are extremely important coastal resources which are vital to our socio-economic development.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Threats, Conservation and Sustainable Use of Mangrove Ecosystem

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Abstract

Mangroves act as coastal guards. They protect coastal regions from storm surges, filter pollutants and harbours wide array of diverse life. They are highly productive and biologically important ecosystems. They provide both ecological and economical benefits to coastal communities. However, mangrove loss is increasing at alarming rate. Under the lucrative name "Development", mangrove forests are being destroyed. In this study, different threats, conservation and sustainable use of mangrove ecosystem are analyzed. The threats to mangrove forests include coastal development, destruction of mangroves for aquaculture, salt production, deforestation and climate change. For conservation of mangrove ecosystem there is need of aforestation, strict legislation including laws and policies, Monitoring and Surveys of land and aerial, etc., Protection including conservation, parks and reserves development, etc. In addition, the sustainable use of mangrove ecosystem is very essential for development of coastal regions. It involves aquaculture - capture fisheries, culture fish, natural products useful for medicinal purposes, drugs, other products like timber, salt production, honey, etc., Socio-economic aspects, tourism and traditional medicines.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Biodiversity in Wild Fauna of Dang Forest Region in Nashik District, Maharashtra

Authors **1. Gavit.M.G and 2. Dr. Sonawane H.B.**

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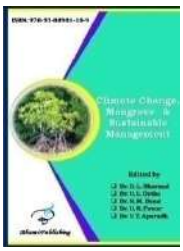
Abstract

Forests play an important role in the life and economy of any country. The moist and dry tropical deciduous forests provide natural and varied ecological habitats for the varied fauna. Nashik district is one of the northern part of Sahyadri in Maharashtra. On the basis of ecological aspects a scientific study has been carried out with respect to wild animal biodiversity in dang forest of Nashik region. The present investigation was done to enlist, identify and number of different species of mammals, reptiles and birds. The moist and dry deciduous forests of north Sahyadri lead to a better natural habitat for wildlife.



Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title # Conservation Strategies of Biodiversity

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Abstract

Biodiversity conservation means saving of all types of life on this planet and keeping healthy and functioning ecosystems. These all ecosystems played a very crucial role in maintaining balance and regulation of climate. To maintain existance of living beings for social benefits the conservation of biodiversity is very essential. There are two main types of conservation strategies of Biodiversity viz. In-situ and Ex-situ. In-situ conservation includes conservation of life on earth in their natural habitats eg. National parks, Sanctuaries, Reserviors. Ex-situ conservation means 'off site' conservation eg. Gene bank, Sperm bank, Ova bank, Seed bank, Botanical gardens, Zoo garden etc. There are some kinds of conservation strategies of biodiversity viz. stopping of the cutting of trees, prevent hunting of animals, natural resources should be properly utilized, human activities should be strictly prohibited in conserved plant and animal area. Some projects were come into existance to save the endangered and threatened species of animals and plants viz. Tiger project, Crocodile project, Rhino project, Mangrove Action Project (MAP) etc. The main objectives of conservation of Biodiversity is preservation of genetic diversity of plant and animal species, sustainable utilization of life support systems, preservation of wild animals and plants, getting benefits of biodivarsity to the society in the form of tourism and recreation. Thus the conservation strategies of biodiversity would be serve as "Treasury" in future.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title **Mangrove – Interesting Group of Plants**

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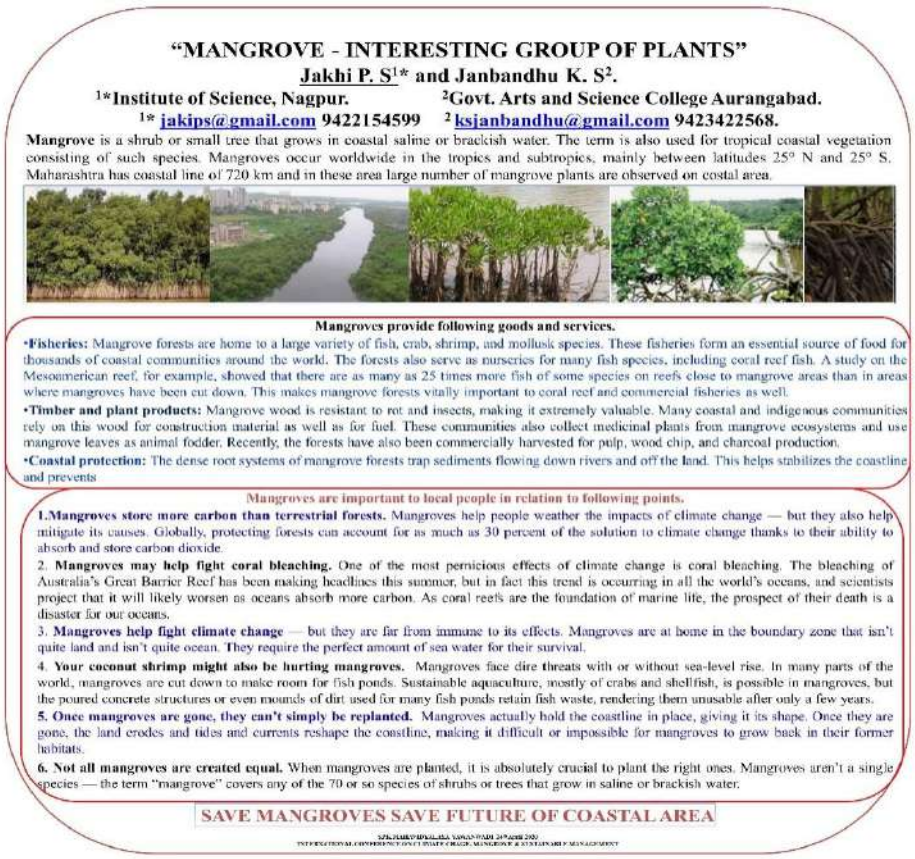
Abstract Mangroves are very interesting and important group of plants from coastal area. Maharashtra is one of the important state of India having coastal area of about 720 km. Large population of Mangroves available in the coastal area of Mumbai City, Mumbai Suburban, Thane, Palghar, Raigad, Ratnagiri and Sindhudurg. Many more peoples are not aware regarding the important role of mangrove in their life. Mangroves play very crucial role in the livelihood of this area by keeping this view in mind various aspects of mangrove enlisted in the poster. It will be awareness activity regarding mangrove in community.

Poster



Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Expedition through Ecological and Economic Importance of Mangroves

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Abstract

Mangroves are the woody trees or shrubs that live along coastlines within the tropic or sub-tropic latitudes. They are extremely productive plants that provide numerous goods and services to both the marine environment and people. Mangrove forests are ecologically important in many ways. Their dense growth and dense root systems protect shorelines from erosion and storms. Mangrove forests are home to a large variety of fishes, crabs, shrimps, mollusks and several bird species. Mangroves support endangered species by providing habitats and safety from predators. They provide food to birds and mammals in the form of leaves and fruits. In addition, they carry out filtration of water, leaching of heavy metals, carbon sequestration, bioaccumulation etc. Most of them are economically important for human beings. Since thousands of years, mangroves are supporting coastal communities by providing many valuable goods like wood, food, tannins etc. Mangroves like *Sonneretia alba, Conocarpus erectus, Bruguierasexangula, Rhizophora mangle, Rhizophora mucronata* possess valuable and durable wood useful for furniture and construction. They are rich in various secondary metabolites having medicinal values and can be used in formulation of valuable drugs. In addition, mangroves like *Acanthus ilicifolius, Avicennia marina* and *Excoecaria agallocha* spp. possess mosquito larvicides, antifungal, antiviral, anti-cancer and anti-diabetic compounds. Hence, it is utmost important to conserve mangroves via sustainable utilization.

Poster

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title **e-DNA – Biodiversity Conservation Tool**

Authors **Dr. Jyothi V. Mallia**

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Abstract e- DNA refers to environmental DNA which we can isolate from environmental samples like soil, water, feces or air. Extracted DNA can be sequenced and compared with existing databases by phylogenetic analysis and which helps to understand the unknown DNAup to species level by using e-DNA. There is no need of direct sampling of organism and this method monitor whether species is endangered, cryptic, invasive, migratory and endemic. e-DNA also helps in population genetic studies to find the alleles and help to conserve wild organism. Present poster highlights the importance of e-DNA technique which is emerging tool to conserve biodiversity.

Poster

e DNA–Biodiversity Conservation Tool

Jyothi V.Mallia, Ph.D. Assistant professor, SICES College, Ambernath (W)

Environment DNA (eDNA)
- investigate target species, invasive species
- Helps in population genetics studies
- Conservation of wild organism

Method
Collection of DNA samples from the environment and doing its sequencing studies (mtDNA, Genomic DNA) and comparing the Taxonomy .

Significance
Emergent field and hold great potential as population genetics tool kit helps to conserve the endangered or cryptic species with out disturbing their habitat.'

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title **Mangroves Serving the Ecosystem**

Authors **Dr. Priyadarshani Baliram Kamble**

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Abstract The term “mangrove” refers to a tidally influenced wetland ecosystem within the intertidal zone of tropical and subtropical latitudes. Magroves also designates the marine tidal forest that includes trees, shrubs, palms, epiphytes and ferns. These are highly productive but extremely sensitive and fragile.Besides mangrove forests in the particular area harbours other plant and animal species to form unique Mangrove ecosystem.. These mangrove ecosystems are well known for their economical and ecological importance but they are also having cultural importance. They are breeding, feeding and nursery grounds for captive and culture fisheries. The ecosystem has a very large unexplored potential for natural products which are useful in variety of fields like salt production, food, fodder, pharmaceuticals etc. Mangroves are saviours of costlines and proved it during natural hazards like cyclones, storms, tsunami etc. They are with cultural heritage. It’s our duty to protect them.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

A Mini Review on Adaptive Strategies of Mangroves Against Salinity

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Abstract

A present summery cum mini review on adaptive strategies of mangroves against salinity comprises different adaptive ways against stressful environmental factors particularly salinity. The defense against salt stress has categorized in three forms *viz* anatomical, physiological and biochemical defense. The anatomical defense includes waxed epidermis, leaf thickness and salt glands on leaves, physiological defense contents osmolytes accumulation (ex. pinitol, manitol, prolien, aspartic acid and betains), salt secretion, ultra filtration, ion sequestration and antioxidative enzymes synthesis like Ascorbate peroxidase (APX), Superoxide dismutase (SOD), Guaiacol peroxidase (GPX), Glutathione reductase (GR). Whereas, in biochemical strategies shows expression of Betaine-2-aldehydedehydrogenase,AmT1 and AmT2 (coding Betaine/Proline transporter) and excessive aquaporins synthesis. The Mangroves occur in intertidal zones with high salinity, the salt tolerance competence is variable from species to species. Even species belongs to same genus were found to be occupy distinct positions of intertidal zones, indicates that differential ability of salt tolerance. These unique potential of mangroves creates an attention for biologist to study adaptation against salinity and other stress factors. While going through many literatures it was found that the mangrove community creates a unique and remarkable ecosystem as a transition between two contrasting communities (marine and terrestrial). These features make it's an ideal model system for studying adaptive evolution of salt tolerance in plants. **Conclusion:** From the present review it is revealed that mangroves has evolved various adaptive mechanisms for their survival in salty environment and playing crucial role in ecosystem stability by co associating with other biotic factors.

Poster

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title ## Climate Change – Change Yourself

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Abstract

In order to live comfortably in the changing world, we also have to bring changes in our day to day life. If the climate is everchanging, we also have to inculcate changes – on larger scale or smaller scale, that can help us reduce our own personal carbon footprint, for the betterment of our planet. Climate is the defined as an average weather of a region which is specific for a particular region. If we fail to change ourselves, we have to face many adverse consequences like, extreme climatic events, drought, cyclone, pandemic diseases like corona and insect pest outbreaks, heat waves, human starvation on large scale, rise in sea level, extinction of species and many more. Therefore, there is an urgent need to learn ourselves & to educate others about the dangerous consequences of climate change by focusing on some important points like switching to 100% green power, stopping deforestation (converting the climate-damaging carbon dioxide gas into vital oxygen gas), spreading awareness about environment, stopping the chopping of forests, scrubbing carbon dioxide straight from the air, investing in reforestation projects, becoming conservative with energy, investing in recycling, focusing on renewable energies, banning plastic, using energy of our hottest star sun, suppressing population growth, using biofuel- an alternative to petrol and diesel, using sustainable transportation - the bicycle, increasing large tax on the most environmentally damaging products ,discouraging meat consumption, becoming vegan, and adopting the slogan of sharing is caring (cars, cloths, tools etc.).

Poster

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title ## Mangrove Ecosystem

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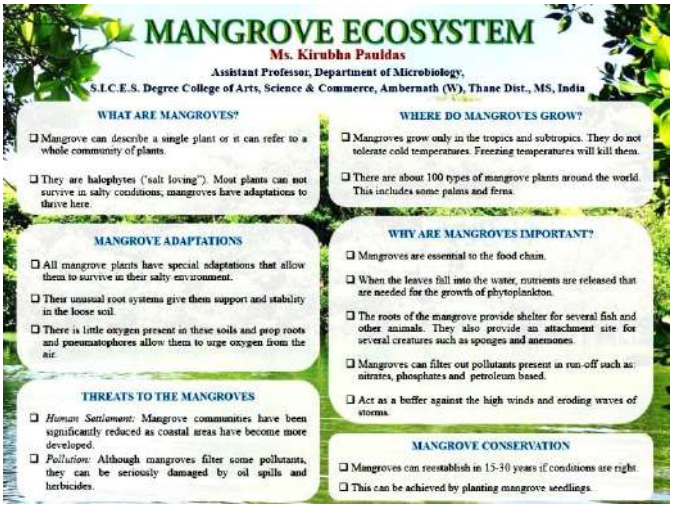
Abstract

Mangroves are among one of the most valuable and productive coastal ecosystems both from an ecological and economic point of view. They include intertidal communities of plants that grow on the shores of coastal lakes and estuaries. These plants are halophytes because they are adapted to salty conditions but they cannot tolerate cold temperatures and hence, are only found in tropics and sub-tropics. They also have special adaptations in their roots called pneumatophores to get oxygen from the air. Mangroves play also a key role in the food chain, nutrient cycling, and also act as a shelter for several fishes and sea-creatures. They also offer protection from catastrophic events, such as tsunami, tropical cyclones, and tidal bores, and prevent erosion. In addition, these habitats also provide opportunities for recreation and tourism and act as an inspiration for culture, art, and design which can alleviate the economic value of the country. Despite the significant roles played by mangrove ecosystems, they are being continuously degraded at an alarming rate, due to direct anthropogenic impacts like reclamation, drainage works, pollution, human encroachment, and due to global changes like global warming. Various activities like fencing along the intertidal zone to prevent livestock access, undertaking rehabilitation projects to restore habitats avoiding sewage discharges, and disposing of rubbish and chemicals responsibly can be implemented to protect mangrove ecosystem. Continued research and monitoring will improve our ability to understand changes in the condition of these communities, and what we can do to better manage them.

Poster



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Diversity of *Avicennia* Species In Gujarat

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Abstract The mangrove forests of the State are represented by 15 mangrove species viz. *Avicennia marina, Avicennia officinalis, Avicennia alba, Acanthus ilicifolius, Aegiceras corniculatum, Bruguiera cylindrica, Bruguiera gymnorrhiza, Ceriops tagal, Ceriops decandra, Excoecaria agallocha, Kandelia candel, Lumnitzera racemosa, Rhizophoramucronata, Rhizophora apiculata, Sonneratia apetala*. Among these 15 species, A. marina is the most dominant species. In fact, it represents about 97% of the total mangrove cover of the State.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title **Terrestrial Vertebrates of Mangroves- A Global Perspective**

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Abstract Salt-tolerant, woody mangroves, which are found globally along the coasts of tropic and subtropical countries, form low-diversity forests with complex food webs. Due to sharp, exorbitant environmental gradient between terrestrial and marine ecosystems, mangroves provide a unique, selective environment that has developed morphological, physiological, and behavioral adaptations amongst the mangrove inhabitant animals. Globally 48 bird, 14 reptile, 1 amphibian, and 6 mammal species have been known endemic to mangroves, of which most are found in Asia and Australia. Currently 40% of these mangrove endemic animals are globally threatened. Across the globe, mangroves and their associated faunal are threatened by anthropogenic activities such as mangrove destruction, overexploitation, pollution and climate change. With the current rate of mangrove destruction and insufficient of knowledge about of terrestrial vertebrates in mangroves, detailed study on these animals is needed to prevent the mangroves and their associated fauna from disappearing entirely.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title **Rapid Urbanization Emerging Threat to Mangrove Ecosystems**

Authors **Ms. Laxmishree Chengala and Dr. Shital Gharge**

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Abstract Mangroves the only tree adapted to tolerate large amount of salt in the water living in two worlds at a time, the interface between land and sea (intertidal zone) found in tropic and sub-tropic. It's a breeding and feeding ground for the many inhabitants of wetland ecosystem and also a source of income for locals. These are the natural barriers of our coastlines protecting us from the nature's wrath like tsunamis, hurricanes and cyclone. And today it has become the most endangered ecosystem due to rapid urbanization.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Expedition through Ecological and Economic Importance of Mangroves

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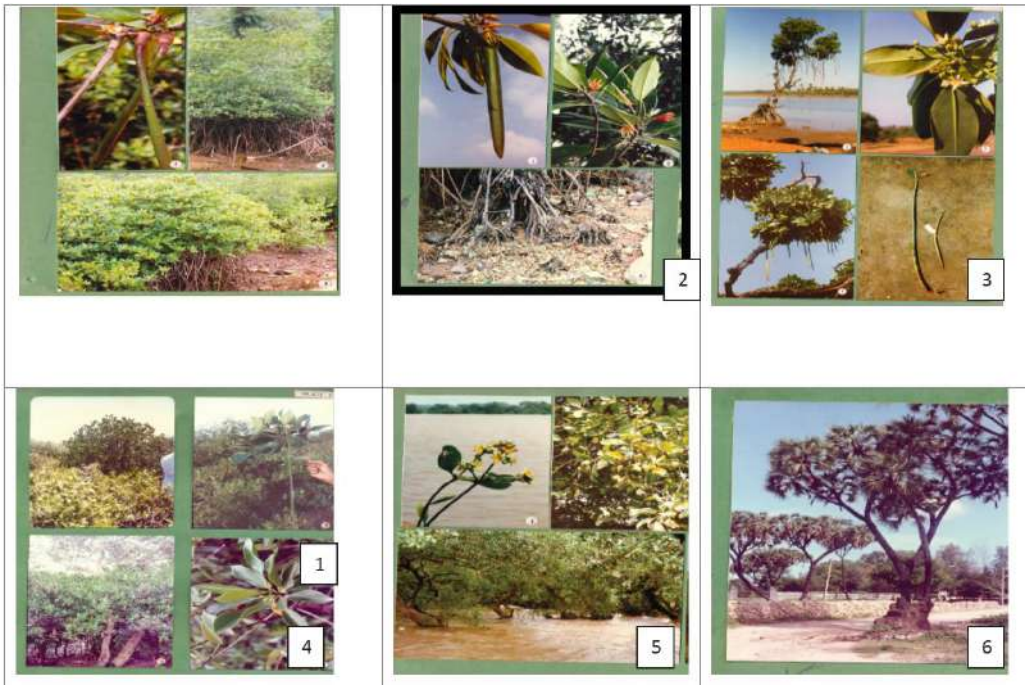
Abstract The poster deals with 6 important Mangroves with economics and medicinal view Point from its diversity of Gujarat, Maharashtra and Goa, The study reveals that there are c22 Mangroves and c68 mangroves associates along the northwest coastal region of India.

Poster



1 Rhizophora apiculata Bl.1 Fruiting 2.2.Habit
2 Bruiguiera gymnorrhiza(L.)Lam. 1.Fruits 2.Flower 3.Rootsystem (Stilt Roots)

3 Rhizophora mucronataL. 1.Habit 2.Flowering 3.Vivipary
4 Bruiguiera cylindrical lBl. Habit and Flowering Branch
5 Avicennia officinalis L. 1. Fruiting 2.Habit
6 Hyphaenedichotoma (White) Furtado–Anendemic to West Coast

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Effect of Vermicompost on Growth and Yield Parameters of Mungbean Varieties for Organic Agriculture

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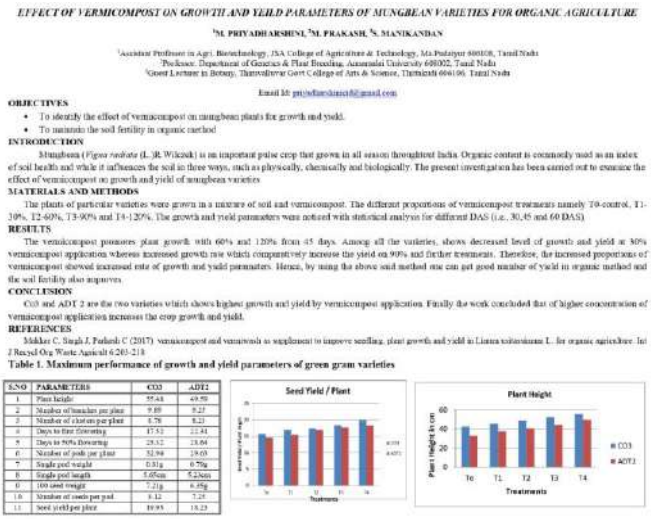
Abstract

Organic content is commonly used as an index of soil health and while it influences the soil in three ways, such as physically, chemically and biologically. Mungbean (*Vigna radiata* (L.) R.Wilczek). is an important pulse crop that grown in all season throughout India. The present investigation has been carried out to examine the effect of vermicompost on growth and yield of mungbean varieties were analysed on 30,45 and 60 DAS. The different proportions of vermicompost treatments namely T0-control, T1-30%,T3-60%,T4-90% and T5-120%.the vermicompost promotes plant growth with 60% and 120% from 45 days. Among all the varieties, co3 and ADT 2 shows decreased level of growth and yield at 30% vermicompost application whereas increased growth rate which comparatively increase the yield on 90% and further treatments. Therefore, the increased proportions of vermicompost showed increased rate of growth and yield parameters.Co3 and ADT 2 are the two varieties which shows highest growth and yield by vermicompost application. Finally the work concluded that of higher concentration of vermicompost application increases the crop growth and yield. Hence, by using the above said method one can get good number of yield in organic method and the soil fertility also improves.

Poster



EFFECT OF VERMICOMPOST ON GROWTH AND YIELD PARAMETERS OF MUNGBEAN VARIETIES FOR ORGANIC AGRICULTURE

OBJECTIVES

- To identify the effect of vermicompost on mungbean plants for growth and yield.
- To maintain the soil fertility in organic method

INTRODUCTION

Mungbean (*Vigna radiata* (L.)R Wilczek) is an important pulse crop that grown in all season throughout India. Organic content is commonly used as an index of soil health and while it influences the soil in three ways, such as physically, chemically and biologically. The present investigation has been carried out to examine the effect of vermicompost on growth and yield of mungbean varieties

MATERIALS AND METHODS

The plants of particular varieties were grown in a mixture of soil and vermicompost. The different proportions of vermicompost treatments namely T0-control, T1-30%, T2-60%, T3-90% and T4-120%. The growth and yield parameters were noticed with statistical analysis for different DAS (i.e., 30,45 and 60 DAS).

RESULTS

The vermicompost promotes plant growth with 60% and 120% from 45 days. Among all the varieties, shows decreased level of growth and yield at 30% vermicompost application whereas increased growth rate which comparatively increase the yield on 90% and further treatments. Therefore, the increased proportions of vermicompost showed increased rate of growth and yield parameters. Hence, by using the above said method one can get good number of yield in organic method and the soil fertility also improves.

CONCLUSION

Co3 and ADT 2 are the two varieties which shows highest growth and yield by vermicompost application. Finally the work concluded that of higher concentration of vermicompost application increases the crop growth and yield.

REFERENCES

Mukher C. Singh J. Pathak C (2017). vermicompost and vermiwash as supplement to improve seedling, plant growth and yield in Linum usitatissimum L. for organic agriculture. Int J Recycl Org Waste Agricult 6:203-218

Table 1. Maximum performance of growth and yield parameters of green gram varieties

S.NO	PARAMETERS	CO3	ADT2
1	Plant height	55.44	49.50
2	Number of branches per plant	9.89	9.23
3	Number of clusters per plant	8.78	8.23
4	Days to first flowering	37.51	32.41
5	Days to 50% flowering	38.52	33.64
6	Number of pods per plant	32.94	29.03
7	Single pod weight	0.81g	0.79g
8	Single pod length	5.05cm	5.24cm
9	100 seed weight	7.21g	6.45g
10	Number of seeds per pod	8.12	7.25
11	Seed yield per plant	10.95	10.23

Climate Change, Mangrove & Sustainable Management

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Title

Role of Filamentous Cyanobacteria Isolated from Sundarbans in Environmental Clean up

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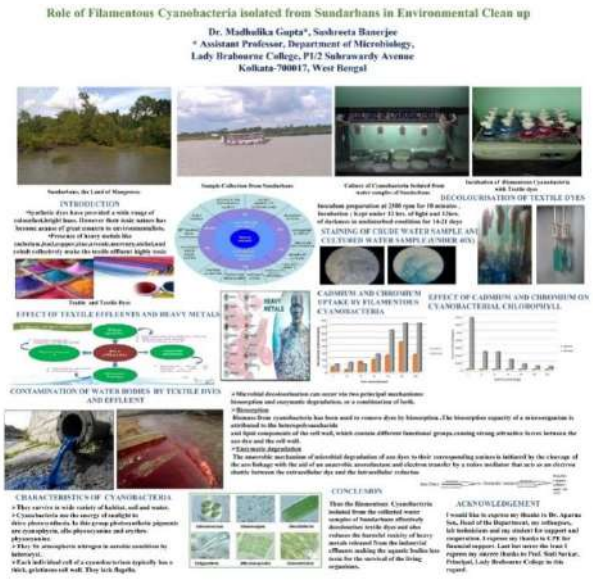
Abstract

Colours give delightful pleasure to eyesight but at the same time they may act as serious pollutants when their origin is dyes and dyestuffs. The dyes are stable and difficult to be degraded due to their synthetic origin and complex aromatic molecular structures. During the synthesis of dyes and other processes it is estimated that about 10-15% of the total production of colorants is lost. The most obvious indicator of water pollution is the coloured industrial effluent. Moreover the presence of heavy metals collectively make the textile effluent highly toxic. The discharge of highly coloured synthetic dye effluents cause considerable damage to the aquatic and human life and is aesthetically very unpleasant. In this project we have isolated Cyanobacteria from the water samples collected from Sundarbans, the land of the mangroves, declared as the World Heritage site in1987. We have proceeded with the filamentous Cyanobacteria for the purpose of decolourisation of textile dyes Direct Blue and Reactive Pink. For Direct Blue (90%) decolourisation occurred but was while quite less for Reactive pink. Microscopic and viability studies were performed. This filamentous Cyanobacteria showed maximum uptake of cadmium and chromium at a concentration of 100mg/l and 200mg/l respectively. Effect of heavy metals on the chlorophyll of Cyanobacteria was also studied. Thus the filamentous Cyanobacteria isolated from the collected water samples of Sundarbans effectively decolourises textile dyes and also reduces the harmful toxicity of heavy metals released from the industrial effluents making the aquatic bodies less toxic for the survival of the living organisms.

Poster



Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title # Mangroves Food Web

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Abstract Mangroves are important component of coastal zone worldwide. The food chain o fa mangrove forest relies heavily on the detritus, made by falling leaves of the trees. This role is mainly filled by the smaller creatures, such as hermit crab and ghost shrimp. Others like the tube worm bristle worm also do this, because they are eating the plant material are considered primary consumers of the ecosystem and the mangroves are main producers. This smaller creatures are smaller fish of mangrove forest. The top level of this food chain are the wading birds such as herono regrets. They feed on The fish is the community who take shelter in the roots of the mangroves trees. Other birds of this ecosystem are pelican and osprey also.
Leaves-detritus-shrimp-small fish-wadding birds(Heron).
Oysters-marine crab-shrimp-Wadding bird(Heron).
This finding can be used as conservation and management of mangroves.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Isolation of Endophytes from *Phoenix Paludosa* (Hetal) of Sundarban Biosphere Reserve and To Explore Their Potentials for Bioactive Compounds

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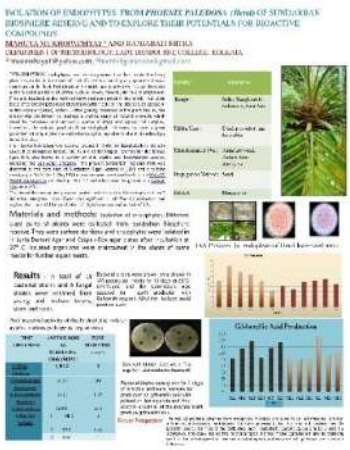
Abstract

The Sundarban Biosphere Reserve extends in India and Bangladesh, is densely covered by mangrove forests, and is one of the largest biodiversity reserve. The present Sundarban National Park was declared as the core area of Sundarban Tiger Reserve in 1973 and a wildlife sanctuary in 1977 and it has been designated as a Ramsar site since 1992. The Mangrove forest is inhabitant by different floral population like *Sonneratia, Phoenix paludosa ,Excoecaria agallocha* etc. Endophytes are a group of microorganism that grow within the tissues of higher plants and colonize them without causing any noticeable injury to the host. Both bacteria and fungi are considered as endophytes. Endophytes represent a potential hub of novel bioactive compounds such as antibiotics, anticancer and other biological control agents. *Phoenix paludosa* belongs to the family Arecaceae and is salt tolerant mangrove plant. . The plants were collected from the Sundarban Biosphere Reserve near Pakhiralay, an Island. Altogether 15 strains of bacteria were isolated from the roots, leaves and stem of the plant. The bacterial population showed a high level of growth hormone production namely Auxin and Gibberellins to the levels ranging from 160 to 300µg/ml and 173µg/ml to 426 µg/ml respectively. The bacterial population even showed antimicrobial activity against human pathogenic strains such as *Escherichia coli, Vibrio cholerae, Klebsiella sp. Psuedomonas aeruginosa, Acinetobacter baumannii* and *Burkholderiasepsia*. Thus the study suggests that these microbes have huge potential to synthesis of numerous novel compounds that can be exploited in pharmaceutical, agricultural and other industries.

Poster



Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title **Mangrove Forest: It's Biodiversity in India & Importance**

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Abstract Mangroves are known due to their uniqueness as well as due to their various resources and ecosystem services. It includes provision services, regulation and maintenance services and cultural services. Mangroves are one of the most threatened coastal ecosystems due to changes in environmental factors and pressure induced by human activities. The present poster focuses on biodiversity and importance of mangroves based on literature survey only.

Poster

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

GC-MS Analysis of Bioactive Compounds of Mangrove Bark

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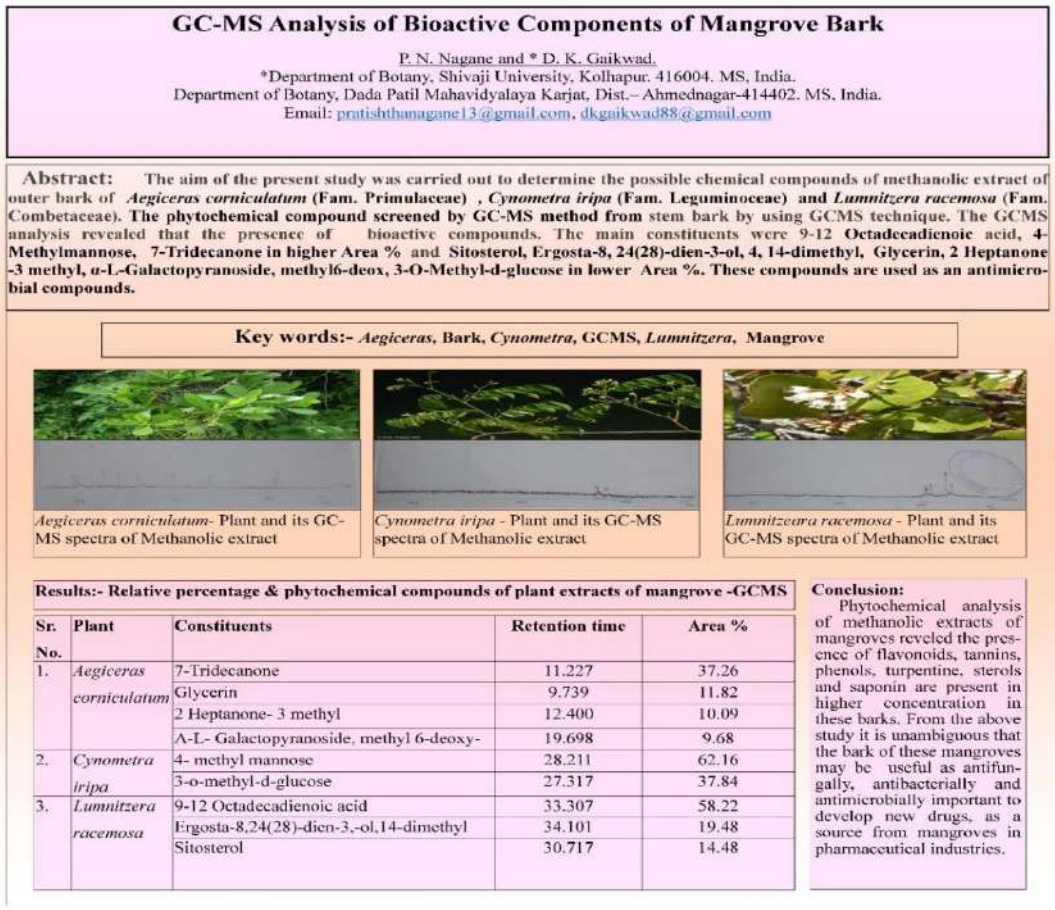
Abstract The aim of the present study was carried out to determine the possible chemical compounds of methanolic extract of outer bark of *Cynometra iripa* (Fam. Leguminoceae) and *Lumnitzera racemosa* (Fam. Combetaceae). The phytochemical compound screened by GC-MS method from stem bark by using GCMS technique. The GCMS analysis revealed that the presence of bioactive compounds. The main constituents were 9-12 Octadecadienoic acid, 4-Methylmannose, 7-Tridecanone in higher Area % and , Sitosterol, Ergosta-8, 24(28)-dien-3-ol, 4, 14-dimethyl, Glycerin, 2 Heptanone-3 methyl, α-L-Galactopyranoside, methyl6-deox, 3-O-Methyl-d-glucose in lower Area %.

Poster



GC-MS Analysis of Bioactive Components of Mangrove Bark

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Abstract: The aim of the present study was carried out to determine the possible chemical compounds of methanolic extract of outer bark of *Aegiceras corniculatum* (Fam. Primulaceae) , *Cynometra iripa* (Fam. Leguminoceae) and *Lumnitzera racemosa* (Fam. Combetaceae). The phytochemical compound screened by GC-MS method from stem bark by using GCMS technique. The GCMS analysis revealed that the presence of bioactive compounds. The main constituents were 9-12 Octadecadienoic acid, 4-Methylmannose, 7-Tridecanone in higher Area % and Sitosterol, Ergosta-8, 24(28)-dien-3-ol, 4, 14-dimethyl, Glycerin, 2 Heptanone -3 methyl, α-L-Galactopyranoside, methyl6-deox, 3-O-Methyl-d-glucose in lower Area %. These compounds are used as an antimicrobial compounds.

Key words:- *Aegiceras*, Bark, *Cynometra*, GCMS, *Lumnitzera*, Mangrove

Aegiceras corniculatum- Plant and its GC-MS spectra of Methanolic extract

Cynometra iripa - Plant and its GC-MS spectra of Methanolic extract

Lumnitzeara racemosa - Plant and its GC-MS spectra of Methanolic extract

Results:- Relative percentage & phytochemical compounds of plant extracts of mangrove -GCMS

Sr. No.	Plant	Constituents	Retention time	Area %
1.	*Aegiceras corniculatum*	7-Tridecanone	11.227	37.26
		Glycerin	9.739	11.82
		2 Heptanone- 3 methyl	12.400	10.09
		A-L- Galactopyranoside, methyl 6-deoxy-	19.698	9.68
2.	*Cynometra iripa*	4- methyl mannose	28.211	62.16
		3-o-methyl-d-glucose	27.317	37.84
3.	*Lumnitzera racemosa*	9-12 Octadecadienoic acid	33.307	58.22
		Ergosta-8,24(28)-dien-3,-ol,14-dimethyl	34.101	19.48
		Sitosterol	30.717	14.48

Conclusion:
Phytochemical analysis of methanolic extracts of mangroves reveled the presence of flavonoids, tannins, phenols, turpentine, sterols and saponin are present in higher concentration in these barks. From the above study it is unambiguous that the bark of these mangroves may be useful as antifungally, antibacterially and antimicrobially important to develop new drugs, as a source from mangroves in pharmaceutical industries.

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Mangroves Can Help to Reach Our Sustainable Development Goals…(SDG)

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Abstract

Mangrove ecosystem is very special type of ecosystem found in very specific region i.e. in intertidal zones. Indonesia and West Bengal serves the largest area of mangroves in the World and India respectively. Mangrove forests are highly productive and diverse ecosystems, providing a wide range of direct ecosystem services for resident populations. In addition, mangroves function as a buffer against frequently occurring cyclones. The Sustainable Development Goals (SDGs) which are set up by the United Nations Assembly it is a "blueprint to achieve a better and more sustainable future for all." SDG14 is reflected importance of restoring and protecting mangroves. It also supports the achievements of many other SDGs. Mangrove forest are very productive and species rich hubs for marine life, they can offer sustainable income to needy people, acts as buffer zones, storm barriers, they can absorb wave energy. India's mangrove serves itself as a home to 4011 species (highest in the world) many of which edible fish and shellfish providing sufficient and nutritious food directly to local communities. Poor and vulnerable populations are benefiting from these readily available sources. It also great carbon sinks and helps in the climate change problems as they isolate carbon at two to four times and store three to five times more carbon per equivalent area than tropical forests. Cutting them down unleashes more greenhouse gas than deforestation elsewhere. The mangroves ecosystems normally filter the amount of sediment and nutrients reaching ocean, disappearance of mangroves has led to an increase in the amount of sediment and nutrients reaching oceanic waters. Excess nutrients may lead to algal blooms (pollution indicator). In most forests, these sediments and litter would decay rather quickly, but because much of it gets submerged in a coastal mangrove forest, there is not enough oxygen to break it down, it leads slow breakdown of materials. A slower decay means more carbon dioxide gets stored. In this review study intended search confirmed that Mangroves are playing an important role in sustainable development.

Poster

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title **Threats and Conservation Strategies for Mangroves**

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Abstract Mangroves are adapted for coastal saline and brackish water as well as tolerant to high salt concentration, varying temperatures, frequent tidal flooding and low oxygen containing soils. Mangroves are famous for their respiratory roots called pneumatophores and development of viviparous propagules for reproduction like mammals. Different species of mangroves play significant ecological services like sea shore stabilization, huge reservoir of carbon, nursery ground for various marine animals, produce secondary metabolites of having medicinal use in the formulation of drugs etc. Recently various man made activities like deforestation, water pollution, uncontrolled shrimp farming, overexploitation mangrove forest products, construction of ports & shore resorts creates threats to mangrove diversity throughout the world. Its urgent need to conserve our mangroves by establishing sanctuaries and protected areas, strict laws & legislations, organizing awareness camps as well as training camps for common peoples with the help of students as well regarding sustainable development and economic importance of mangrove forests.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title **Types of Mangroves**

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Abstract Mangroves are the gift of nature which mostly lives on muddy soil, but some also grow on sand, peat, and coral rock. There are various types of mangroves. In this poster, the classification of mangroves based on topographic and hydrological characters are presented. They are of mainly six types: fringe mangrove, basin mangrove, dwarf mangrove, hammock mangrove, over-washed mangrove and riverine mangroves. The fringe mangrove communities are the one which have normal and classic pattern of zones. They are seen as a fringe along the coast. They directly exposed to tides, waves, storms with high energy. The basin mangroves are partially impounded depressions which are flooded occasionally during dry season and regularly during wet season. The dwarf mangroves are a type of fringe mangrove appearing in colder climate and have sediments with little amount of nutrients. Hammocks are the mangroves which are same as basin mangroves, except they are more elevated than basin mangroves. The over-washed mangroves are the ones which are frequently washed over by tides and wash away organic matter. And the last one riverine mangrove is the one which are floodplains that grow along flowing waters like tidal rivers and creeks.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Threats to the Ocean Due to the Loss of Mangrove Ecosystem

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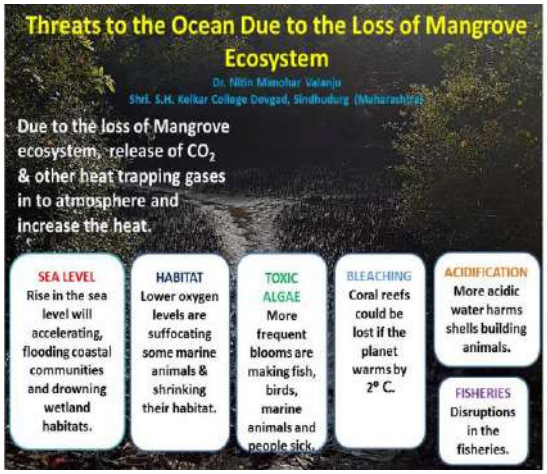
Abstract

Mangroves are amongst the most productive marine ecosystems on Earth, providing a unique habitat opportunity for many species, key goods and services for human beings. Mangrove habitats are regressing at an alarming rate, due to direct anthropogenic impacts and global change. Threats to mangrove forests and their habitats is due to the urban development, river changes, fishing, destruction of coral reefs, pollution, aquaculture, mining, and over-exploitation of timber and global rise in sea level. The removal of mangroves from coastal ecosystems can have drastic effects on the water quality, population's distribution and density of the mangrove ecosystem and surrounding ecosystems; both aquatic and terrestrial. The removal of mangroves and their ecosystem can also drive region-specific organism toward extinction. Due to the loss of mangrove ecosystem, release of CO2 and other heat trapping gases in the atmosphere will increase the heat, rise in the sea level will cause drowning of wetland habitat, lower oxygen level will suffocate marine animals and shrinking their habitats, increase the growth of toxic algae, loss of coral reefs and loss of shell building animal due to acidification. The loss of mangrove ecosystem will have devastating economic and environmental consequences for coastal communities. This study strengthen the need to preserve mangrove forests and to restore those degraded to guarantee the provision of goods and services needed to support the biodiversity and functioning of wide portions of tropical ecosystems.

Poster



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title **Mangrove Ecosystem**

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Abstract Mangroves are one of the world's dominant coastal ecosystems comprised chiefly of flowering trees and shrubs uniquely adapted to marine and estuarine tidal conditions. The structure and composition of mangrove ecosystem is discussed along with species diversity and distribution at different locations. Mangroves are one among the most productive and biologically important ecosystem on this planet, providing vital ecosystem goods and services. Consolidation of data pertaining to the extent and diversity of mangroves is a pre requisite for the selection of any strategy for the conservation of existing or the introduction of newer population. Mangrove ecosystem, an unique, fragile, highly productive ecosystem in the sea - land interphase, is the conglomerations of plants, animals and microorganisms acclimatized in the fluctuating environment of tropical intertidal zone. This ecosystem is a highly valued ecosystem in terms of economy, environment and ecology. The biodiversity includes true mangrove plants (34 species) and their associate plant species (40), 150 species of algae, 163 species of fungi, 32 species of lichen, 250 species of fishes, 7 species of amphibian, 59 species of reptiles, around 200 species of birds, 39 species of mammals, besides numerous species of phytoplankton, zooplankton etc. and mangrove plant dependant insects. Species composition ,and their distributional pattern, population dynamics and community structure of different groups of fauna experience wide range of changes spatially and temporally because of the prevalling fluctuating environmental condition. Tempreture, rainfall and tidal mixing mostly make this environment unstable with a wide range of variation of major ecological parameters like salinity, pH, dissolved oxygen, nutrients, turbidity etc. from east to west in different periods of year. This ecosystem maintains rural economy by providing timber,fuelwood,and faunal resources honey etc. However, the bidiversity and ecosystem functioning are being threatened because of several reasons like deforestation,erosion and unwanted salinity invasion etc.

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title **Highlights on Role of Mangroves for Ecosystem Stability**

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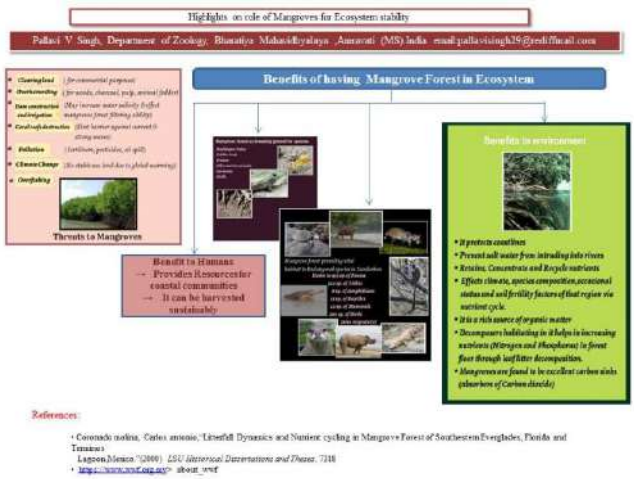
Abstract Present review highlights the role of Mangroves for Ecosystem stability. The review comprises of two main subjects 'Threats to Mangroves' and 'Benefits of having Mangrove Forest in our Ecosystem'. Threats to Mangroves include Anthropogenic activities or natural phenomenon that leads to its destruction. Activities- like Clearing land for agriculture or other commercial purposes; Overharvesting for self-benefit to obtain woods, charcoal, pulp animal fodder etc. ; Dam construction and irrigation may lead to an increase in water salinity and thereby directly effecting filtering ability of Mangroves; Coral reefs habitat destruction adversely effects Mangroves as they act as first barrier against water current and strong waves; Pollution due to excessive use of fertilizers, pesticides and oil spill from cargo ships; Overfishing for commercial benefits. Presence of Mangrove Forest in our Ecosystem benefits Human, beside flora benefits habituating fauna species and its major contribution is in stabilizing its Estuarine Ecosystem. To humans it provides resources for coastal communities and can be harvested sustainably. To fauna like Mudskipper Fishes, Fiddler crab, Prawns, Barnacles, shells, other marine animals they provide breeding grounds. Beside they shealter 120 sp. of Fishes; 8 sp. Of Amphibians; 35 sp. of Reptiles: 42 sp. of Mammals; 290 sp. of Birds including both local and migratory birds. To its Ecosystem it contributes by protecting coastlines from cyclones, it prevents salt water from intruding into rivers, retains concentrate and recycles nutrients, effects climate, species composition, occasional status and soil fertility factors of that region via nutrient cycle; it provides rich source of organic matter and decomposers thus at the floor of forest increases nutrients like Nitrogen and Phosphorus by decomposition. Mangroves are found to be excellent carbon sinks. Conclusion: Conservation of Mangroves is need of hour as Mangroves being major component of Estuarine Ecosystem contributes through its morphology and physiological activities in stabilizing its Ecosystem.

Poster



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title **Importance of Mangroves**

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Abstract The mangroves have a significant role in conserving the coastline biodiversity by the protecting shorelines from damaging storm and hurricane winds, waves and floods. And provide the natural infrastructure and protected to nearby populated areas by preventing erosion and absorbing storm events such as hurricanes. The root system of mangrove trees helps form a natural barrier against violent storm surges and flood and erosion. Provide valuable protection for communities at risk from sea level rises and weather events by climate change. And they maintain water quality by the filtering pollutants, and it provides a vulnerable nursery for fishes, molluscs and crustaceans. Commonly refers to tidal swamp ecosystem in tropical deltas, estuaries, lagoons or islands the characteristic tree species populating this ecosystem, these trees unique adaptations to the harsh conditions of coastal environments and And they are the carbon sinks to fight against global warming by removing the carbon dioxide from atmosphere due to supports a threatened and endemic and endangered species. Peoples have utilized these plants as a renewable resource harvested for durable, water-resistant wood, for used in building houses, boat, pilings and furniture. And the wood of black mangrove and buttonwood trees and also has been utilized in the production of charcoal, tannin's and other dyes are extracted from the mangrove bark, Leaves have been used in livestock feed, tea, medicine and etc.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Mangrove Restoration Camp at Village Taramumbari Tal. Devgad . Dist. Sindhudurg

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Abstract

Mangrove restoration is the regeneration of mangrove forest ecosystems in areas where they have previously existed. The practice of mangrove restoration is grounded in the discipline of restoration ecology, which aims to the recovery of resilience and adaptive capacity of ecosystems that have been degraded, damaged, or destroyed"[FSM 2000]. Since environmental impacts are an ongoing threat, to successfully restore an ecosystem implies not merely to recreate its former condition, but to strengthen its capacity to adapt to change over time. By considering this fact we arranged and participated in different camp for mangrove restoration at village Taramumbari.

Poster

Climate Change, Mangrove & Sustainable Management
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Title

Mangrove Forest: Benefits, Threats, Carbon Sequestration Potential, and Management Approaches

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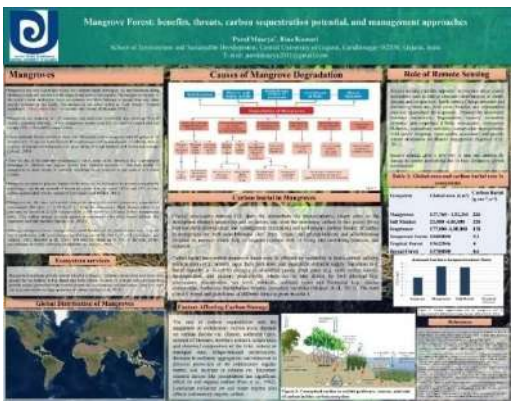
Abstract

Mangroves are very highly specialized salt resistant plants thriving in the intertidal areas along sheltered coasts and estuaries in the tropical and subtropical regions. They are one of the most productive ecosystems on earth, forming 15 million ha of forest worldwide. They are vital to our socio-economic development as they provide both ecological and economic benefits to support coastal communities' for their livelihood. Mangroves ecosystem helps in the biogeochemical cycling of nutrients (phosphorus, carbon, and nitrogen), soil formation, wood production, ecotourism, providing commercial fisheries resources, provide nursery grounds for coastal fish and crustaceans. They stabilize sediments, provide physical protection to coastlines from tidal erosion, storm surges, tsunamis, and cyclone and trap sediment for land accretion. Mangroves have significant carbon storage potential, they sequestering carbon and storing it in the above ground biomass, below ground biomass, litter, sediments etc. Sequester and stored carbon in mangrove, termed as "blue" carbon. Yet, these forests are among the most threatened habitats in the world due to rapid change in Land use/Land cover. In the last 50 years, between 30-50% of mangroves have been lost globally and they continue to be lost at a rate of 1-2% each year. For the conservation and management of mangroves, we should consider in association with local community participation, the Remote Sensing technique, and Geographic Information System based comprehensive database approach. By this, we get real-time data of inaccessible areas; quantify the change detection, and the effects of human pressure on a landscape, that can be used for effective conservation management. Further, by studying the dynamic nature of the ecosystem both spatially and geochemically, it is possible to understand the present and future trends.

Keyword: Mangroves, Benefits, Threats, Land use/Land cover, Remote Sensing, GIS

Poster



Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title **Mangrove Biodiversity and Ecosystem Functions**

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Abstract Mangroves are amongst the most productive marine ecosystems on Earth, providing a unique habitat opportunity for many species and key goods and services for human beings Mangrove is a term used to describe a group of highly adapted tropical intertidal trees or shrubs that share the feature of growing with their roots in brackish water or seawater. The physiology of these plants is quite unusual and is a product of convergent evolution; mangroves come from many families. Mangrove forests make up one of the most productive and biologically diverse ecosystems on the planet. Mangroves forests serve as an ecosystem stabilizer since they play an important role in providing habitats for many terrestrial and aquatic species along with a huge capability of carbon sequestration and absorbing greenhouse gases. Mangrove Ecosystem on continental land masses and isolated island offer unusual potential as natural experiments for Biodiversity and Ecosystem Function studies, largely sites with similar physical environments can have clear contrasts in the diversity of producers. These contrasts provide a starting point for exploring the role of species diversity of higher plants in modulating biogeochemical functions (e.g. production, nutrient cycling), ecological functions (e.g. habitat for organisms in different tropic levels), and anthropogenic functions (e.g. maintenance of fisheries, management of sediments), on a range of time scales. Mangrove habitats are regressing at an alarming rate, due to direct anthropogenic impacts and global change.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title **Mangroves: A Bane or a Boon?**

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Abstract There are increasing number of environmental problems of which one of them is pollution. This also involves deforestation of Mangroves. Mangroves are a group of trees and shrubs that live in the coastal intertidal zone. But there has been a lot of debate with the presence of them and lot of real estate people are destroying it in the name of acquiring more land. The work presents how mangroves are important for protection from hazards such as tsunami.

Poster

MANGROVES: A BANE OR A BOON?

By Dr. Payal Rane - Acharekar[1], Dr. Ambika Joshi, Dr. Nitesh Joshi[2]
[1] Jai Hind College, Mumbai 20, [2] Rizvi College

Abstract: There are increasing number of environmental problems of which one of them is pollution. This also involves deforestation of Mangroves. Mangroves are a group of trees and shrubs that live in the coastal intertidal zone. But there has been a lot of debate with the presence of them and lot of real estate people are destroying it in the name of acquiring more land. The work presents how mangroves are important for protection from hazards such as tsunami.

Introduction:
Mangroves grow in areas with low-oxygen soil, where slow-moving waters allow fine sediments to accumulate. Mangrove forests only grow at tropical and subtropical latitudes near the equator because they cannot withstand freezing temperatures. They have a dense tangle of prop roots that make the trees appear to be standing on stilts above the water. This tangle of roots allows the trees to handle the daily rise and fall of tides, which means that most mangroves get flooded at least twice per day. The roots also slow the movement of tidal waters, causing sediments to settle out of the water and build up the muddy bottom. Mangrove forests stabilize the coastline, reducing erosion from storm surges, currents, waves, and tides. The intricate root system of mangroves also makes these forests attractive to fish and other organisms seeking food and shelter from predators. (2009) There are about 80 species belonging to 20 families, the most common of which are *Rhizophora*, *Bruguiera*, *Ceriops*, *Kandelia* all belonging to Rhizophoraceae (Nagarajan B et al, 2008). Mangroves Help Fight The Effects Of Climate Change. So Why Is Mumbai Destroying Them? Bare trees with slender branches line a half-built highway overpass in eastern Mumbai. These are mangroves, trees or shrubs found in tropical swampy marshland with roots that grow above the ground. But construction has blocked their lifeblood — salt water. Their aerial roots poke through dry, caked mud instead of brackish water. Environmentalist B.N. Kumar points to a small channel under the highway where seawater once entered the mangrove patch. It's now littered with rocks and construction debris. "All the mangroves, about 5,000 of them, have dried up. They can only be used as firewood now," Kumar says. "It's very sad to see these mangroves dying like this."(Pathak Sushmita, Nov, 2019). Nearly 50 cases on the destruction of the city's mangroves, which play a key role in absorbing the impact of flooding and are rich in flora and fauna, have been registered between January and July this year. The cases relate to debris dumping, encroachment, hacking, blocking of tidal water to the mangroves and destruction of wildlife. Twenty-seven cases relate to destruction of wildlife, including flamingo poaching and beaching of Dolphins. Another 12 cases are on debris dumping and eight on encroachment (Bhalerao Sanjana, Aug, 2019). Mumbai has 6,600 hectares (ha) of mangrove cover, with 6,400 ha in the suburbs and 200 ha in south Mumbai. Of this, close to 4,500 ha is on government land and rest in private areas. Navi Mumbai and the eastern end of Thane creek have 1,471 ha of mangroves. Projects such as Essel world, Bandra reclamation, Navi Mumbai airport and many more have resulted in the destruction of the mangroves."

Fig 1: showing presence of Mangroves before and after the Navi Mumbai airport

Fig 2: showing presence of Mangroves at Bhandup Wetlands, Mumbai in 2003 and 2017

Observation & Conclusion:
1. It is observed that Mangrove forests specifically, their thick, impenetrable roots are vital to shoreline communities as natural buffers against storm surges, an increasing threat in a changing global climate with rising sea levels.
2. Mangroves, specifically the underwater habitat their roots provide, offer critical nursing environments for juveniles of thousands of fish species, from 1-inch gobies to 10-foot sharks.
3. The area of mangrove can be completely plastic free zone.
4. Blue carbon ecosystems (mangroves, sea grasses and salt marshes) can be up to 10 times more efficient than terrestrial ecosystems at absorbing and storing carbon long term, making them a critical solution in the fight against climate change.
5. We are not against development but not against the cost of environment"', Thus a Conservation Action trust by Mr Debi Goenka
6. In 2005, Mumbai faced the biggest flooding due to destruction of Mangroves along the banks of Mithi River.
7. The Bombay High Court had ordered the state government to launch criminal action against those who destroy mangroves.

Methodology:
1. Conservation of the existing mangroves. (By declaring it as reserved forests)
2. Helping in natural reproduction than replantation. (the reproduction occurs only during high tides which helps in pollination of flowers as they need to be well hydrated. (Nagarajan B et al, 2008)

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2. Social Entrepreneurs: Taking on World Problems, 25th November, 2019
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4. Nagarjan B, Pandiarajan C, Krishnamoorthy M and Sophia P: Proceedings of Taal 2007, the 12th World Lake conference: Pg 29 – 33 5. Conservation International, USA

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Isolation and Identification of Fungal Endophytes from a Mangrove: - *Sonneratia apetala* L.

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Abstract

Mangrove plants are native of saline and marshy areas. Adaptation in such environmental conditions requires a set of adaptive mechanisms for stress amelioration and survival. A group of fungi, which resides inside the plant body, are known as Fungal Endophytes that forms symbiotic association with plant. The fungal endophytes helps the plants in enhancing production of stress responsive metabolites and in return plant provide them nourishment and shelter. *Sonneratia apetala* belongs to family Lytheraceae grows in harsh environment; any organism that is isolated from this species would be of huge interest due to its potential in having bioactive compounds. In the present work, fungal endophytes were isolated from *Sonneratia* leaves using Potato Dextrose Agar (PDA) media. The leaves were surface sterilized and placed on PDA media and incubated at 28oC and observed everyday for fungal growth. The colonies developed from inside the leaves were picked and inoculated on fresh PDA media. After sporulation, three major fungi i.e. *Aspergillus niger, Aspergillus flavus*and *Trichoderma viridae* were identified based on colony characters. This work is first report of isolation and identification on fungal endophytes from *Sonneratiaapetala*. These fungi will be further characterized for their ability to produce novel secondary metabolites having antioxidant and antimicrobial activities.

Poster

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Mangrove: A Unique Ecosystem

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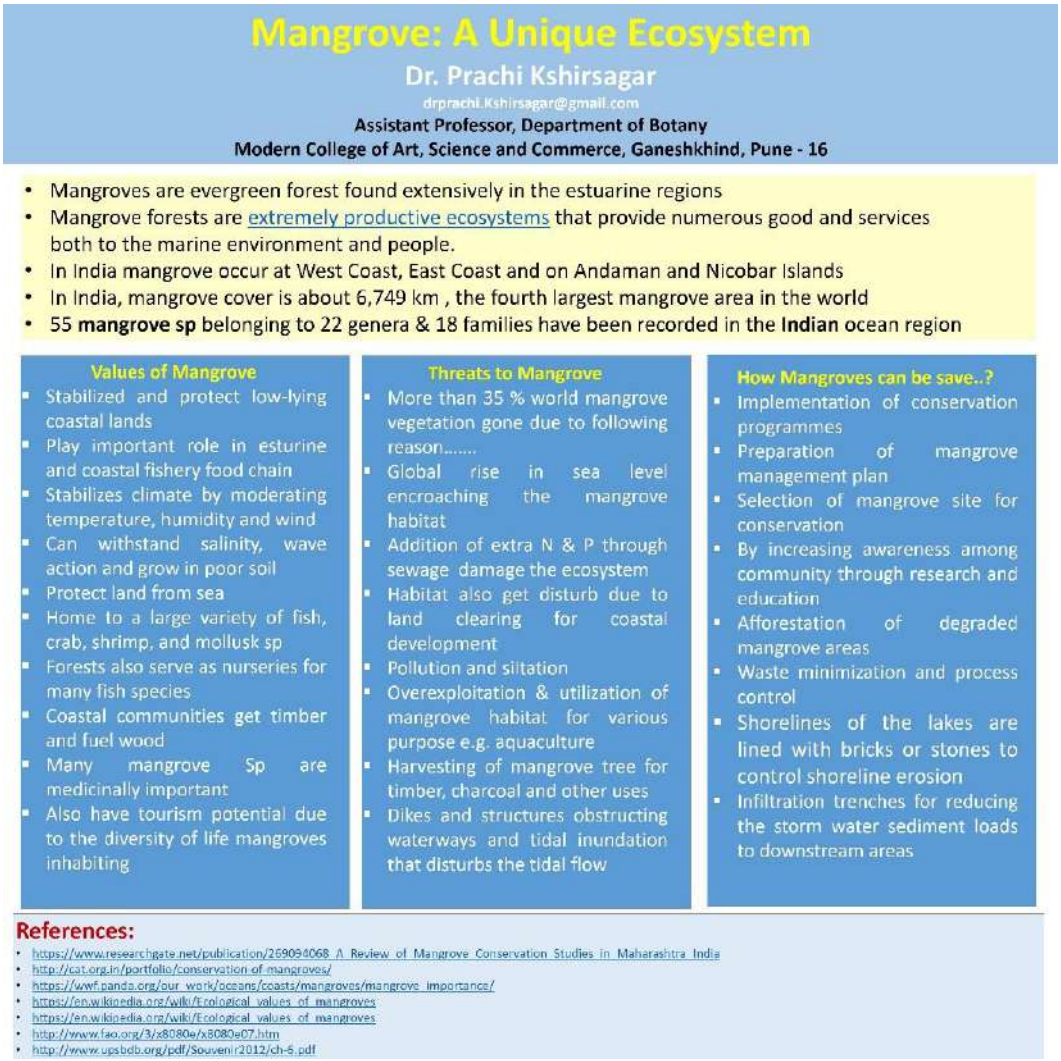
Abstract Mangrove is one of the important ecosystem found in estuarine region. The ecosystem is thought to be extremely productive as it provides various goods and services to nearby community and marine organisms. Now a days due to various environmental issues like climate change and habitat destruction the ecosystem is under threat. This is the need of hour to protect this most fragile and important ecosystem. In the present poster various values, threats and management practices are discussed.

Poster



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Blue Carbon Farming Through Mangrove Ecosystem

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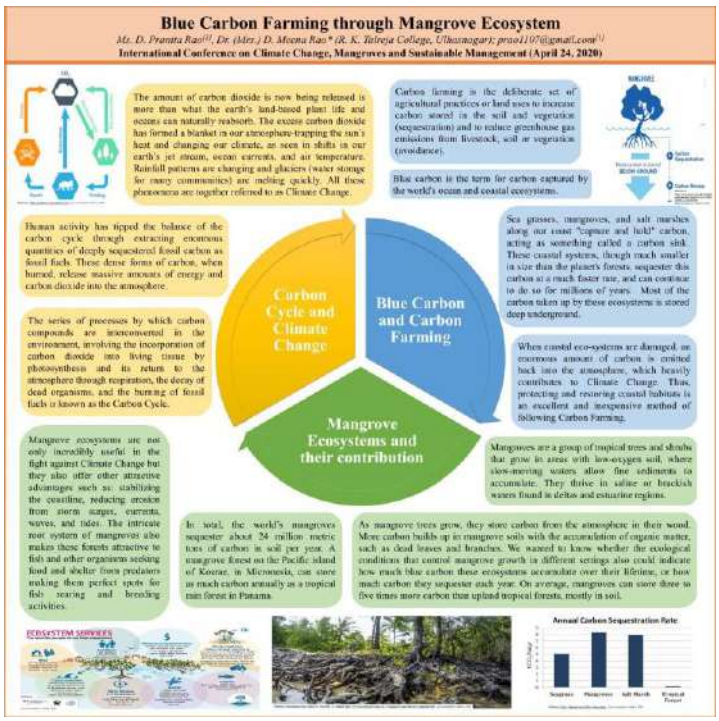
Abstract

Due to the continuous emissions of carbon dioxide from industrial processes and fossil fuel combustion in automobiles, the total amount of carbon dioxide in the atmosphere has exceeded normal levels. This excess carbon dioxide traps the heat from the sunrays and results in an increase of the world's temperature. As a result of this increase in temperature, the Earth's climate and ecosystems are undergoing changes which are adversely affecting all life forms on Earth. Carbon farming is the process of planting and nurturing plants with the intention of sequestering carbon to the ground. This phenomenon is the only viable solution to balance the carbon offsets. The carbon that gets sequestered by marine and coastal ecosystems is known as Blue Carbon. Mangrove ecosystems are the most efficient carbon sinks and hence, best sources of Blue Carbon capture and storage. Studies have shown that mangroves are capable of storing nearly 24 million tons of Carbon per year making them our best tools against climate change. None of the other ecosystems green or blue are capable of delivering such high results. Apart from this, mangrove ecosystems are also helpful in fish-breeding, stabilizing coastlines and preventing erosion. Hence, it is imperative that we as earthlings, act responsibly and start restoring our mangroves.

Poster



Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title # Nature-Based Solutions and Human Well-Being

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Abstract Air temperatures are increasing because of global climate change. It has been shown that the hotter temperatures occurring in cities during the summer negatively affect human wellbeing. The Nature based Solutions are intended to support the achievement of society's development goals and safeguard human well-being in ways that reflect cultural and societal values and enhance the resilience of ecosystems, their capacity for renewal and the provision of services. Nature based Solutions are designed to address major societal challenges, such as food security, climate change, water security, human health, disaster risk with social and economic development.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title **Biotechnological Potential of Mangrove Fungi**

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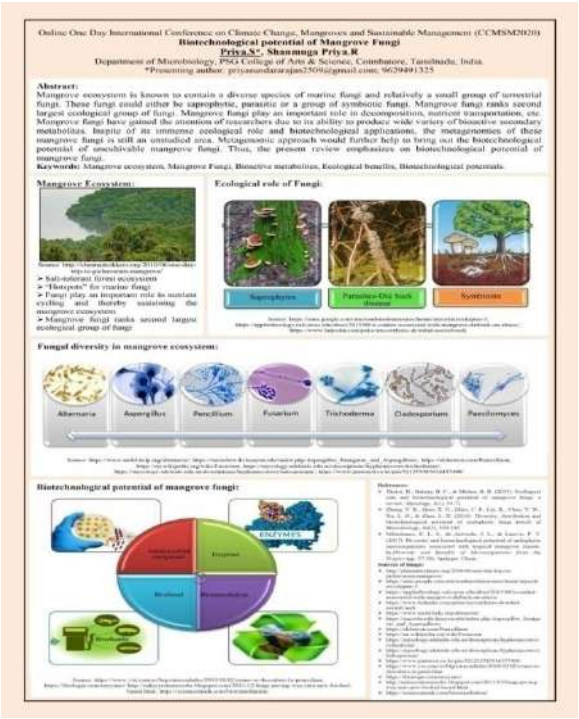
Abstract

Mangrove ecosystem is known to contain a diverse species of marine fungi and relatively a small group of terrestrial fungi. These fungi could either be saprophytic, parasitic or a group of symbiotic fungi. Mangrove fungi ranks second largest ecological group of fungi. Mangrove fungi play an important role in decomposition, nutrient transportation, etc. Mangrove fungi have gained the attention of researchers due to its ability to produce wide variety of bioactive secondary metabolites. Inspite of its immense ecological role and biotechnological applications, the metagenomics of these mangrove fungi is still an unstudied area. Metagenomic approach would further help to bring out the biotechnological potential of uncultivable mangrove fungi. Thus, the present review emphasizes on biotechnological potential of mangrove fungi.

Poster



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Pollution Load Destructs Mangrove Ecosystem In and Around The World

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Abstract

Healthy mangrove ecosystems are vital for the wellbeing, food security, and protection of coastal communities worldwide. Mangroves are among the world's most dynamic ecosystems. But increasing encroachment by development and industry means they are also among the most at risk. They are being destroyed at rates 3-5 times greater than average rates of forest loss. Over a quarter of the world's original mangrove cover has already disappeared. One of the main threats to mangroves is from habitat destruction for coastal development and aquaculture. Pollution and over-exploitation are also reducing the ecosystem services provided by mangroves. Changes in local water conditions caused by upstream dams, irrigation and pollution have led to the loss of many mangroves. Rising sea levels are a longer-term challenge. The paper presents reports that highlight current status of destruction of mangroves due to pollution.

Poster

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title **Threats of Mangrove Ecosystem**

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Abstract

Mangroves are a group of trees and shrubs that live in the coastal intertidal zone. There are about 80 different species of mangrove trees. All of these trees grow in areas with low-oxygen soil. Mangrove forests only grow at tropical and subtropical latitudes near the equator, It has been proved that the presence of mangrove ecosystems on coastline save lives and property during natural hazards such as cyclones, storm surges and erosion. They are breeding, feeding and nursery grounds for many estuarine and marine organisms. Hence, these areas are used for captive and culture fisheries. The ecosystem has a very large unexplored potential for natural products useful for medicinal purposes and also for salt production, apiculture, fuel and fodder.The threats of the mangrove ecosystem could be grouped into two: Natural and Anthropogenic threats. Natural threats including the cyclones, typhoons and strong wave action, crabs which attack on young seedlings and girdle the root collars, wood borers, caterpillars which eat the mangrove foliage and damage the wood as well and beetles, drying and mortality of mangrove trees.The Anthropogenic threats are large-scale collection of mangrove fruits, cultivation of paddy by uprooting the mangrove land, discharge of industrial pollutants into creeks, rivers and estuaries, Grazing of mangrove by cattle, Urban development, fishing that damage to young seedlings also uprooted the mangrove.

Poster

MANGROVE ECOSYSTEM - Its Threats

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Introduction:

The term "mangrove" refers to a tidally influenced wetland ecosystem within the intertidal zone of tropical and subtropical latitudes. Mangrove also designates the marine tidal forest that includes trees, shrubs, palms, epiphytes and ferns.
It has been proved that the presence of mangrove ecosystems on coastline save lives and property during natural hazards such as cyclones, storm surges and erosion. These ecosystems are also well known for their economic importance. They are breeding, feeding and nursery grounds for many estuarine and marine organisms. Hence, these areas are used for captive and culture fisheries. The ecosystem has a very large unexplored potential for natural products useful for medicinal purposes and also for salt production, apiculture, fuel and fodder, etc.

Threats to Mangrove ecosystem:

The threats to the mangrove ecosystem could be broadly grouped into two: Natural and Anthropogenic

Natural threats:

- cyclones, typhoons and strong wave action especially in the geographically vulnerable Andaman and Nicobar Islands.
- crabs, which attack young seedlings, girdle the root collars and eat the fleshy tissues of the propagules.
- insect pests such as wood borers, caterpillars (which eat the mangrove foliage and damage the wood as well) and beetles.
- drying and mortality of mangrove trees
- weeds such as Acrostichum aureum and Acanthus species, which often occupy deforested mangrove areas and restrict the regrowth of economic mangrove tree species.

Anthropogenic threats:

- Illegal large-scale collection of mangrove fruits (Xylocarpus granatum, Xylocarpus moluccensis, Nypa fruticans and Heritiera littoralis), which hinders their natural regeneration (fruits are probably used in production of medicine).
- encroachment on publicly owned mangrove forest lands, e.g. cultivation of paddy observed on government land which involved uprooting of natural and planted seedlings.
- lack of interest of private landowners (village communities and individuals) in conserving and developing the mangroves on their lands.
- discharge of industrial pollutants into creeks, rivers and estuaries, which is a major problem in some regions of the world.
- Tree felling for fuel wood and wood products.
- Grazing by cattle.
- Reclamation for agriculture and aquaculture.
- Urban development.
- the traditional use of dragnets in fishing, which often hampers regeneration of mangroves because young seedlings get entangled in the nets and are uprooted.

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Mangrove: Key to the Coast

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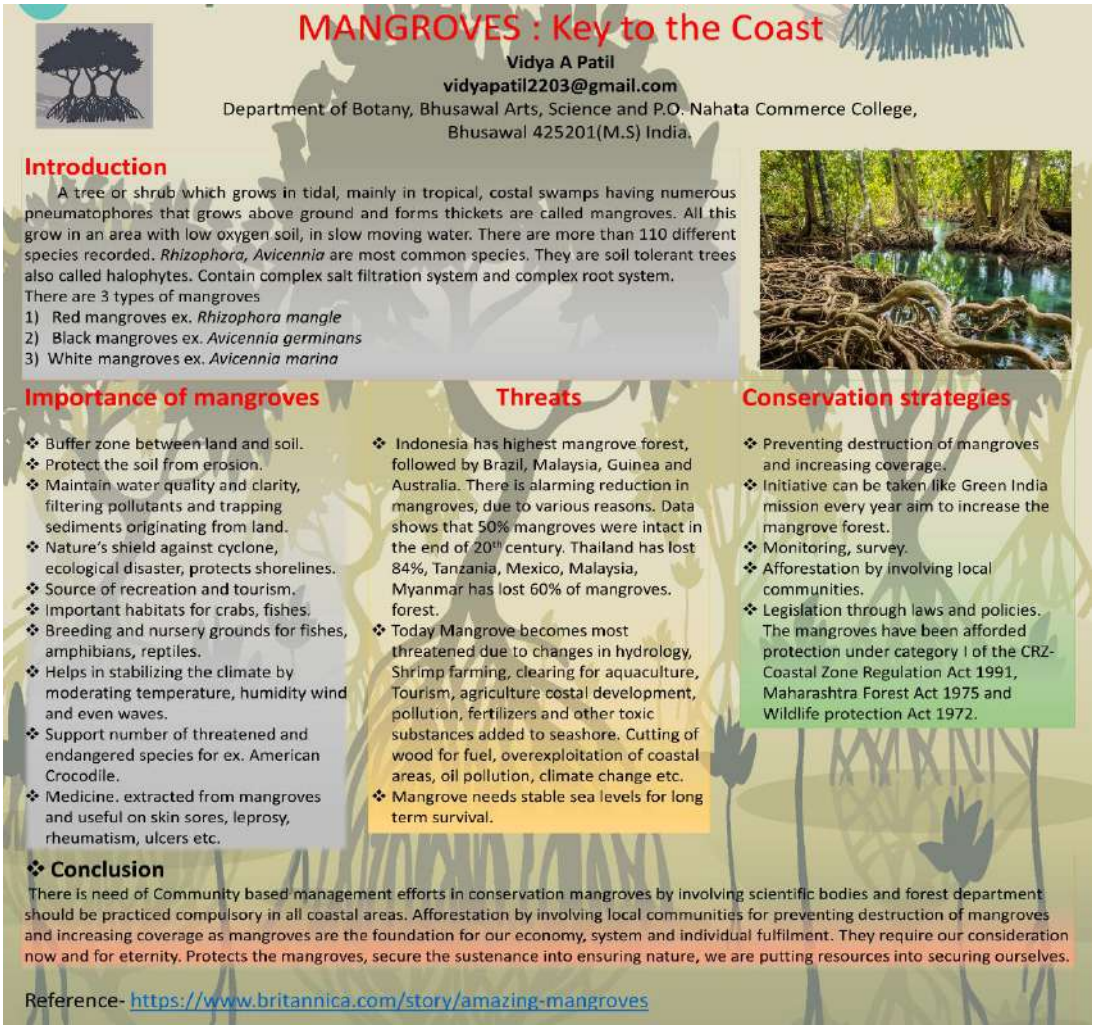
Abstract

Mangroves are the characteristic intertidal plant formation of sheltered tropical and sub-tropical coastlines. There are more than 110 different species recorded from different countries by researchers. Mangroves are soil tolerant trees, also called halophytes. Contain complex salt filtration system and complex root system. Mangroves represents most productive biologically important ecosystem on the planet. Present article deals with types, threats, importance and few conservation strategies for mangroves.

Poster



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Anatomy and Ecology of Mangrove plant *Sonneratia apetala*

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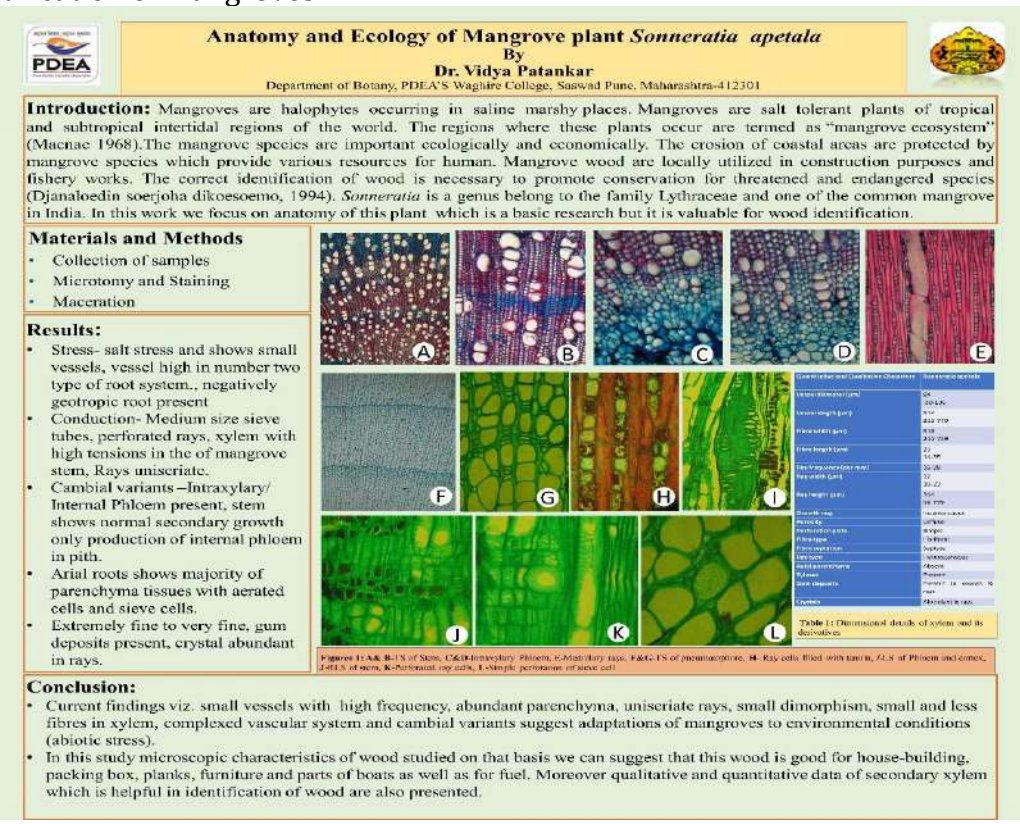
Abstract

Mangroves are halophytes occurring in saline marshy places. Mangroves are salt tolerant plants of tropical and subtropical intertidal regions of the world. The regions where these plants occur are termed as "mangrove ecosystem" (Macnae 1968). The mangrove species are important ecologically and economically. The erosion of coastal areas is protected by mangrove species which provide various resources for human. Mangrove wood is locally utilized in construction purposes and fishery works. The correct identification of wood is necessary to promote conservation for threatened and endangered species (Djanaloedin soerjoha dikoesoemo, 1994). *Sonneratia* is a genus belong to the family Lythraceae and one of the common mangroves in India. Anatomy reveals because of salt stress it shows small vessel with high in number. Xylem with high tensions in the stem of mangrove and rays uniseriate. Intraxylary/ Internal Phloem present, stem shows normal secondary growth only production of internal phloem in pith. Arial roots show majority of parenchyma tissues with aerated cells and sieve cells. In this work we focus on anatomy of Sonneratia apetala which is valuable for wood identification of Mangroves.

Poster



Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Living on the Edge: Current Status and Threats on Mangroves

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Abstract

As per the ISFR 2017 report, the total area of mangrove cover of India is 4921 km2, (181 km2positively changed with respect to 2015 mangrove cover assessment) which contributes 3.3% to the global mangrove cover. The deltas of the Ganges, Mahanadi, Krishna, Godavari, and Kaveri rivers contain mangrove forests. A scientific study reported that 100 per cent of mangrove species, 92 per cent of mangrove associates, 60.8 per cent of algae, 23.8 per cent of invertebrates and 21.1 per cent of fish are under threat. Periodical monitoring of the mangrove forest is very much necessary to assess the status. The impact of environmental and human interference on marine flora and fauna needs to be assessed. The traditional rights of coastal communities to use the natural resources in their surrounding natural habitats for their livelihood should be recognized while formulating and implementing regulations and conservation measures on priority basis.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title **Threats to Mangroves**

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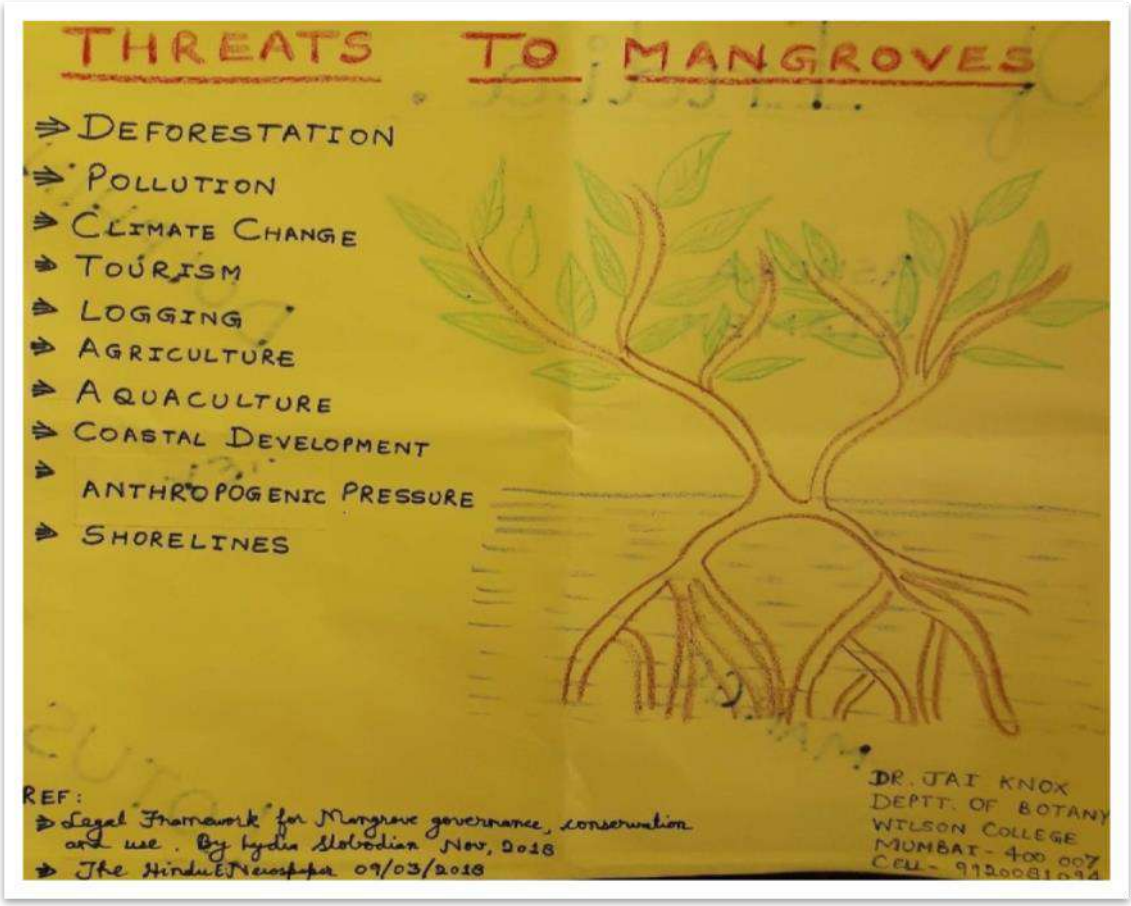
Abstract Mangrove forests are one of the world's most threatened tropical ecosystems. There are various factors which threaten mangrove ecosystems. The major ones are deforestation, pollution, climate change, tourism, logging, agriculture, aquaculture, coastal development, anthropogenic pressure and shorelines. Solid waste and effluents which are discharged in the rivers in city like Mumbai faces a huge risk. Mangroves are much affected by the change in climate such as increase in temperature, natural calamities which ultimately affect the growth of mangroves. If the above mentioned factors continue to grow in such a rapid speed there are chances that mangrove vegetation will soon become extinct in which coastal areas and island like Maldives, Indonesia etc. will vanish thereby affecting the livelihood. Conservation needs to be linked with broader perspective.

Poster



Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Mangrove Biodiversity: Yesterday and Today A Statistical Study

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Abstract

Mangroves are shrubs or small trees that grow in coastal saline or brackish water. Mangrove swamps (mangals) are found in tropical and subtropical tidal areas. Areas where mangroves occur include estuaries and marine shorelines. Mangrove plants require a number of physiological adaptations to overcome the problems of low environmental oxygen levels, high salinity and frequent tidal flooding. So some are shorelines, mangrove tree species show distinct zonation. About 110 species are considered "mangroves", in the sense of being a tree that grows in such a saline swamps (gen. Rhizospora).The ecosystem that these trees create provides a home (habitat) for a great variety of other species, including as many as 174 species of marine megafauna. Mangrove forests make up one of the most productive and biologically diverse ecosystems on the planet. It is found that due to the increase in global warming and pollution the diversity of mangroves and the diverse ecosystem hold by mangroves had been decreased to a large extent both in India and around the globe. Statistically it is found that in 1980's the area of the world covered was 18.79 million hects that had decreased to 15.23 million hec in 2005. As In case of India even the mangrove forest has decreased due to afforestation, pollution from1800 sq.km in 1986 to 1600 sq.km in 2015.Proper sustainable management for the mangrove conversation has to be brought in practice so as to save the ecosystem from getting depleted.It's necessary to save the biodiversity of the mangroves so as to save the ecological biodiversity.

Poster

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title **Role of Mangroves**

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Abstract Mangroves are shrubs or small trees that grow in costal saline or brackish water. They are salt tolerant trees and are called halophytes. They are well adapted to these conditions with crop roots and have pneumatophores and are unique in the reproduction by vivipary.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title **A Profile of Mangrove Ecosystem and Its Restoration**

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Abstract

Mangroves are amongst the most productive marine ecosystems on earth, providing a unique habitat opportunity for many species, key goods and services for human beings. It is helpful in maintaining delta building process and soil conservation. It stands as natural wall against catastrophic events, such as tsunami, storms, tropical cyclones and tidal bores and can dampen shoreline erosion. Mangrove habitats are reducing at an alarming rate of 1–2% per year, due to direct anthropogenic impacts and global change. Restoration of mangrove ecosystem is very essential for sustainability of life. Mangrove wetlands restoration is return from a disturbed or totally altered condition, not only to previously existing condition, but to a defined better or improved state. This can be achieved by good understanding of the ecological and hydrological conditions of the site. Restoring water flow and land elevation facilitates the natural transportation of mangrove propagules, and over time mangrove regeneration can occur. Planting of mangrove vegetation can help to accelerate recovery rates. Ecological knowledge is essential to place species at their respective location within the system and at different elevations. Long term monitoring and management of the site should be implemented. These approaches, applied together, will facilitate effective mangrove restoration. Successful restoration can greatly contribute to goods and services to local communities; help nations to grow ecologically and economically and support conservation of mangrove flora and fauna and it plays key role in carbon emissions and even help in the urgent fight to slow down climate change

Poster

A PROFILE OF MANGROVE ECOSYSTEM AND ITS RESTORATION

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INTRODUCTION

Mangrove ecosystems are of great ecological and economic significance. They cover 15,000,000 ha, with high biomass and economic values. These forests, at the land-sea interface, provide food, breeding grounds and nursery sites for a variety of terrestrial and marine organisms. Mangroves are amongst the most productive marine ecosystems on Earth, providing a unique habitat opportunity for many species and key goods and services for human beings. Mangrove habitats are reducing at an alarming rate, due to direct anthropogenic impacts and global change. Despite their importance, mangroves are disappearing at a global loss rate of 1–2% per year, and the loss rate reached 35% during the last 20 years. Climate changes including sea level rise and altered rainfalls and human activities such as urban development, aquaculture, mining, and overexploitation of timber, fish, crustaceans and shellfish, represent major threats for mangrove habitats.

FUNCTIONS OF MANGROVE ECOSYSTEM

- **Productive:** Production of high quality construction timber and poles, fuel wood having high calorific value, pulpwood, fodder for domestic animals and non-timber-forest-products including tannin, medicines, adhesives, etc.
- **Ecological:** It provides spawning and nursery grounds for fish and crustaceans. It is helpful in maintaining delta building process such as land forming. Soil conservation along the river and creek banks. It serves as ecological habitat for wildlife viz., birds, otter, crocodile, etc.
- **Protective:** It stands as natural wall against catastrophic events, such as tsunami, storms, tropical cyclones and tidal bores and can dampen shoreline erosion. It protects wide diversity of flora and fauna by providing Shelter. It also protect environment through carbon emission.

RESTORATION

Ecosystem restoration is a resetting of a deteriorated condition as that of preserved reference site which represents the structural and functional variability within habitats before any disturbance. According to Lewis (1990) mangrove wetlands restoration is "return from a disturbed or totally altered condition by some action of man". Restoration not only refers to return to previously existing condition, but to a defined better or improved state.

KEY POINTS OF MANGROVE RESTORATION

- **Understanding:** Good understanding of the conditions of the site being restored, including prior knowledge of both ecology and hydrology.
- **Restoration of physical hydrological process:** Restoring water flow and land elevation facilitates the natural transportation of mangrove propagules, and over time mangrove regeneration can occur with or without planting.
- **Planting:** Planting can help both to accelerate recovery rates and in places where natural recruitment may be reduced.
- **Ecological knowledge:** The correct species must be placed at the correct location within different parts of a system and at different elevations.
- **Monitoring and management:** Long term monitoring and management of the site should be implemented into the project protocol. This must entail monitoring the growth and survival of mangrove species, as well as carrying out ongoing or additional hydrological modifications, supplementary planting or weed/pest removal.

These approaches, applied together, should facilitate effective mangrove restoration.

CONCLUSION

Many methods have been highly refined over a period of time and, if properly applied, they show high rate of success. Successful restoration can greatly contribute to goods and services to local communities; help nations to grow ecologically and economically and support conservation of mangrove flora and fauna and it plays key role in carbon emissions; and even help in the urgent fight to slow down climate change.

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Mangrove Vegetation in Karnataka: An Overview

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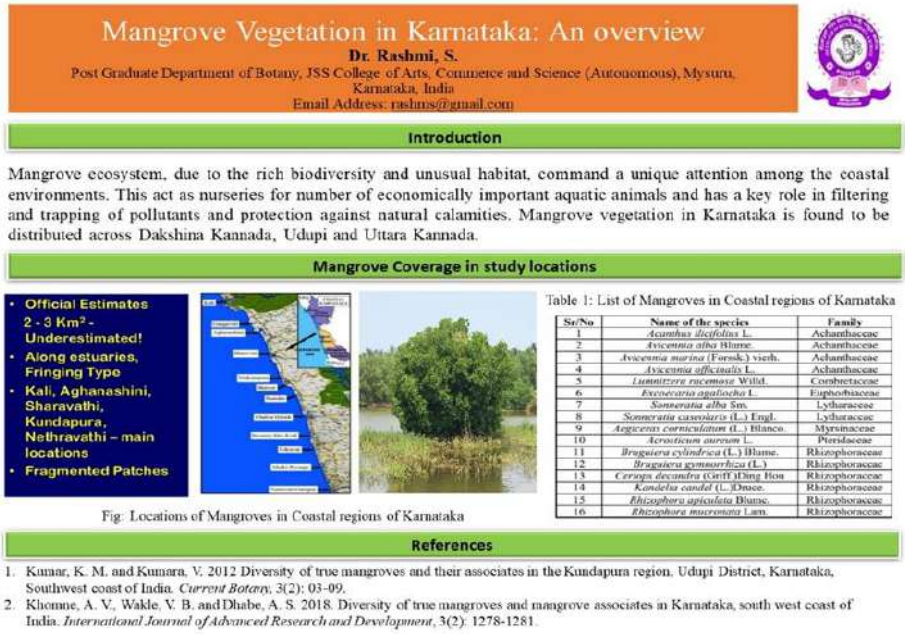
Abstract

Mangrove ecosystem, due to the rich biodiversity and unusual habitat, command a unique attention among the coastal environments. This act as nurseries for number of economically important aquatic animals and has a key role in filtering and trapping of pollutants and protection against natural calamities. Mangrove vegetation in Karnataka is found to be 300 hectares distributed across three coastal districts- Dakshina Kannada, Udupi and Uttara Kannada. In Dakshina Kannada diversity of mangroves are found from Netravathi - Gurupura estuary, Mulki-Pavanje, Udayavara-Pangala, Swarna-Sita-Kodi, Chakra-Haladi-Kollur, Baindur hole and Central Marine Fisheries Research Institute. In Uttara Kannada the mangroves are present in the Venkatapur, Sharavathi, Aghanashini, Gangavali and Kali river estuarine complexes. And Kundapur region in Udupi District. The coasts have a total of 16 species of mangroves belonging to 8 families. The Mangroves species available in Coastal zone of Karnataka are *Acanthus ilicifolius, Acrosticum aureum, Aegiceras corniculatum, Avicennia alba, Avicennia marina, Avicennia officinalis, Bruguiera cylindrica, Bruguiera gymnorrhiza, Ceriops decandra, Excoecaria agallocha, Kandelia candel, Lumnitzera racemose, Rhizophora apiculate, Rhizophora mucronate, Sonneratia alba and Sonneratia caseolaris.* The impact of mangrove plants on marine carbon inventories suggests that the mangroves account for more than 10% of the terrestrially derived dissolved organic carbon transported to the ocean, while they cover only 0.1% of the continents' surface. In Karnataka, Mangroves possess the highest carbon stocks in biomass (50.40 tC/ha). Mangroves also acts as green shields buffering the coastline against sea erosion, and potentially devastating impacts of cyclones and tsunami.

Poster



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Environmental Impact of Mangroves Destruction

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Abstract

Mangrove forest are referred as tidal forest, belong to the category of tropical wetland rain forest ecosystem. Mostly mangrove forests are found in the alluvial deltas of Ganga, Gadavari, Krishana and Kaveri. The Sundarbans is the largest mangrove forest in the world. Mangroves are one of the precious elements of coastal ecology due to their role as a sustainer of biological diversity of the region. It protects shorelines from damaging storm and hurricane winds, waves, and floods. It also helps prevent erosion by stabilizing sediments with their tangled root systems. They maintain water quality and clarity, filtering pollutants and trapping sediments originating from land. The intricate root system of mangroves also makes these forests attractive to fish and other organisms seeking food and shelter from predators. It isolates carbon at four times than rate of tropical forests like Amazon. They also provide livelihood opportunities to coastal communities. The mangroves are destructed by fertilizers, pesticides, and other toxic man-made chemicals carried by river systems from sources upstream can kill animals living in mangrove forests, while oil pollution can smother mangrove roots and suffocate the trees. The major threats to mangrove forests include population explosion, conversion to aquaculture ponds, clear-felling for timber, charcoal and wood chip production for industrial and urban development. Mangroves are to be saved. Thus environmental monitoring in the existing mangrove areas should be taken up systematically and periodically. Threats to the mangrove resources and their root causes should be identified. Though, Mangroves provide essential habitat for thousands of species. It should be protected.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title **Save Trees Save Life**

Authors **Dr. Ritesh Kumar Singhal**

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Abstract In this poster we observe that children are saving trees from the woodcutter as he is about to cut trees. As a woodcutter, he has to cut trees for his livelihood, but he doesn't have any idea that he is causing a great harm to the natural environment. The trees are important as they give us oxygen and absorb carbon dioxide and play an important role in purifying Mother Earth. Due to forests we all are getting fruits; ayurvedic leaves found in forests are used for making ayurvedic medicines. Forests and trees support other animal life also which are crucial to maintain earth's natural balance. If we cut trees it will lead to soil erosion and landslides. Soil erosion will lead to loss of crop productivity and will reduce the availability of foodgrains for human beings which will further lead to malnutrition. Trees also help to reduce the green house gases in the atmosphere. In the picture, the children are saving trees because they know the importance of trees and are also trying to convince the woodcutter to save the trees. The children ran from their school to save trees as it is an important work. By cutting the trees, we are all in fact endangering our own lives. Save trees, save life.

Poster

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Tapping the Potential of Mangrove Forest in Bee Keeping: An Income Generating & Mangrove Conservation Model for India

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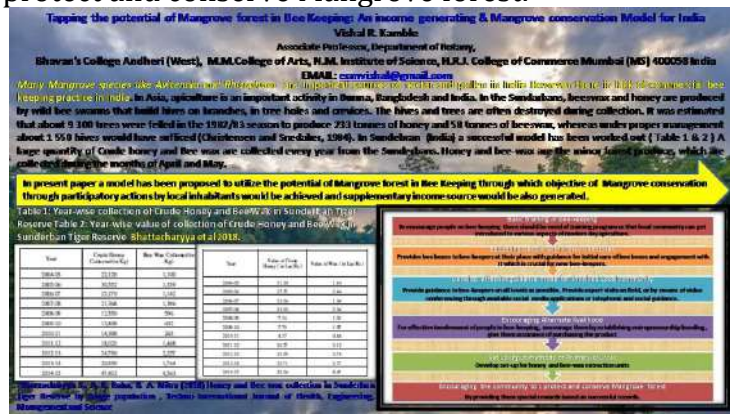
Abstract

Many Mangrove species like *Avicennia* and *Rhizophora* are important sources of nectar and pollen in India. However in context with Indian mangrove vegetation there is lack of commercial bee keeping practice. In Asia, apiculture is an important activity in Burma, Bangladesh and India. As reported in earlier studies conducted at Sunderbans Mangrove forest, collection of beeswax and honey produced by wild bees and swarms from hives build on branches, or in tree holes and crevices is commonly practised by local inhabitants. During this collection hives and trees are often destroyed. According Christensen and Snedaker, Report (1984) report 233 tonnes of honey and 58 tonnes of beeswax was collected at the cost of 9300 tree fall but under proper beekeeping practice in Mangrove about 1 550 hives would have sufficed. There is drastic development in bee keeping practice has been found in recent few year at Sunderban region. However, other part of India it is not yet seriously considered as new avenue. In present paper a model has been proposed to utilize the potential of Mangrove forest in Bee Keeping through which objective of Mangrove conservation through participatory actions by local inhabitants would be achieved and supplementary income source would be also generated. This Model consists of: (i) Basic training in bee-keeping (ii) Equipping people with honey bee boxes (iii) Develop effective guidance mode for involved Local community (iv) Encouraging Alternate livelihood (v) Set up input methods of Primary sources and (vi) Encouraging the community to protect and conserve Mangrove forest.

Poster



Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title Indian Diversity-Mangrove ecosystem

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Abstract

Indian Diversity-Mangros ecosystem

- Mangrove in India is world famous for its gorgeous variety of flora and fauna and also for its huge area. The Mangroves are actually salt-tolerant plants of humid regions and they are mainly found in the Godavari-Krishna and Sunderban regions in India.The 'Sunderban Mangroves' occupy a huge area followed by the Andaman-Nicobar Islands and Gulf ofKutch in Gujarat.

- There are several places in India where Mangrove is found including the Godavari-Krishna and Sunderban. Mangrove occurs on islands in the Indian Ocean, Arabian Sea, Bay of Bengal and the Sunderban is considered as the largest mangrove forest in the world.

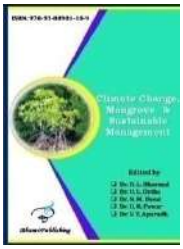
- Sunderban:located in the Ganges delta in the state of West Bengal.

1. Godavari-Krishna Mangroves

- Some of the other significant Mangrove forests found in India include the 'Bhitarkanika Mangroves' and 'Godavari-Krishna Mangroves'. The second largest mangrove forest in the world, the 'Pichavaram Mangrove Forest' is situated near Chidambaram in South India. It is also one of those rare mangrove forests, which has actually increased by 90% between the years of 1986 and 2002.

Source: Kathiresan, K. and Qasim, S. Z., Biodiversity of Mangrove Eco- systems, Hindustan Publishing Corporation, New Delhi, India, 2005, p. 251.

Dr.S.Jenifer (Assistant professor),Department of Biotechnology,AJK college of Arts and



Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Green Audit: A Tool For The Study of Climate Change

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Abstract

Green audit is one of the tools for the study of changes in climate of a specific area. It is also useful in determining proper utilization of natural resources. This paper deals with the audit of various practices adopted by the educational institutes such as water consumption and water harvesting, electricity consumption and use of non conventional energy resources, generation of solid waste, e-waste and their disposal, consumption of chemicals and their disposal for maintaining sustainability in the college campus. As educational institutes are leaders in social reformation, they have to play key role in maintaining the sustainability. As per famous phrase Charity begins at home, educational institute have to take initiative at their campus. Green audit is one of the tool for optimization of use of natural resources, control on pollution and maintaining sustainability in an organization Now it is need of hour to take joint efforts by Governments, NGO`s and educational institutes for curbing these problem

Poster

GREEN AUDIT: A TOOL FOR THE STUDY OF CLIMATE CHANGE

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ABSTRACT: Green audit is one of the tool for the study of changes in climate of a specific area. It is also useful in determining proper utilization of natural resources. This paper deals with the audit of various practices adopted by the educational institutes such as water consumption and water harvesting, electricity consumption and use of non conventional energy resources, generation of solid waste, e-waste and their disposal, consumption of chemicals and their disposal for maintaining sustainability in the college campus.

INTRODUCTION: The population explosion, rapid industrialization and various developmental activities has exerted tremendous pressure on our environment. It has lead to serious environmental issues such as acid rain, depletion of ozone layer, global warming and other life threatening effects. By adopting practice of green audit in schools, colleges and other institutions we can access the changes in climate of a specific area.

PROCEDURE OF GREEN AUDIT:

- The green audit is initiated with the active participation of all concerned stakeholders of the organization. After thorough preparation, the audit is started. Documents to be produced at the time of green audit are as follows.
- Record of annual water consumption and water harvesting unit details.
- Record of annual electricity consumption.
- Record of annual electricity generated via solar energy unit.
- Record of annual generation of solid waste, e-waste and their disposal.
- Record of annual consumption of chemicals and their disposal.
- Record of floral diversity in and around area of institution.
- Record of faunal diversity in and around area of institution
- Record of green practices adopted by the institution such as eco-club,
- cycle- club etc.

ASSESSMENT OF GREEN AUDIT (MARKS-100):

S.N.	Unit of Assessment	Marks
1	Diversity of flora	20
2	Diversity of fauna	20
3	Water conservation	10
4	Solar energy generation	10
5	Electricity conservation	10
6	Solid waste disposal	10
7	Disposal of chemicals	10
8	Green practices	10

GRADATION

Grade	Score	Remark
A	Above 90	Excellent
B	76-90	Very Good
C	61-75	Good
D	50-60	Satisfactory
E	Below 50	Poor

CONCLUSION:
The Green Audit of institutes is essential in order to improve the quality of Environment. It also supports the up-gradation of floral and faunal diversity. The weak units as pointed by auditors can be taken care by parent organization for enhancing the quality of environment. Final Grade Awarded is ----------
Recommendations (If any) ----------

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Birds (Anseriformes: Anatidae) of Mangrove Forest

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Abstract Mangrove forest harbours a very rich biodiversity. These are the suitable nesting and alimental grounds for the birds in particular. The birds belonging to Anatidae are comparatively large and flightless or limited flight. Therefore these birds construct the nests on ground. For construction of the nest suitable material for nest construction is available at large. Similarly these mangrove forests shows richness and abundance of food items of these anatids. Anatids are generally herbivorous as adults feeding on aquatic plants although some species eat fish, molluscs and crustaceans and aquatic insects. These birds are adapted for swimming, floating on the surface and in some cases diving in at least shallow water. Though this family contains around 146 species belonging to 43 genera, only four species wiz. Indian Spot Billed Duck (Anaspoecilorhyncha), NothernShowvelar (Anascypeata), Lesser Whistling Duck (Dendrocygnajavanica) and Rudy Shelduck (Tadurnaferruginea) have been exhibited in this poster.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title **Mangroves Ecosystem**

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Abstract The word “mangrove” is consider to be a combination of the Portuguese word “Mangue” or the Spanish word “Mangle” which is combined with English word “grove”. The dictionary meaning would be “grove made up of mangue/ mangle” (Vanuacci 1989). Mangroves are salt – tolerant plants. These are highly productive but extremely sensitive and fragile. Mangroves are breeding, feeding and nursery grounds for many estuarine and marine organisms. Mangroves contain approximately 70 vegetation species in 40 genera. A study on the diversity composition, distribution pattern and quantitative analysis of mangroves vegetation. Raigad district has five estuaries supporting mangrove vegetation namely Bankot, Shriwardhan, Roha, Murud-Janjira, Alibag. In the Raigad mangrove vegetation B.gymnorrhiza and B.cylindrica are disappearing. A.marina dwarf are the dominant species. S.alba is restricted in a Raigad district. L.racemosa and S.apetala are found in Raigad district. Thus the present study reflects that mangroves present in this area are under high level of disturbance and needs priority for conservation measures.

Poster

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Mangrove: It is A Life of Flora and Fauna

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Abstract Mangroves are trees or shrubs that occur in foreshore or seashore areas and are a part of topical costal ecosystem. It creates unique ecological environments that host rich gathering of ecosystem. It is also called as “Blue Forest” on the planet. It is composed of various flora and fauna but mangrove plant is the most important component. This plant grows in marshy, brackish, briny or other type of coastal waters. This ecosystem is very unique ecosystem in the earth, which is under threatening condition due to loss of habitat, aquaculture and overharvesting and major ratio of population. Mangroves wetlands provide habitat, feeding, breeding and nursery areas for a wide variety of flora and fauna including endangered species. It is very beneficial for Reaction and transportation, Transportation as well as Education and research point of view. Emphasis has been given to understand the presence of organic and inorganic pollutant and the mangrove and ecosystem to tolerate the ratio of population increasing day by day. Healthy flora and fauna species in India also have the ability to change the function of heavy metals present on mangrove.

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Role of Phytoremediation by Mangroves Plants

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Abstract Mangroves are facultative halophytes and form a unique group of intertidal ecosystems. The role of Phytoremediation by mangrove plants and their associated microbes for environmental cleaning, has gained acceptance in the past 10 years as a simple, eco-friendly, cost-effective, non-invasive alternative or complementary technology for engineering-based remediation methods. Mangrove sediments showed unique potential in many- fold increase for most metal (loid)s than plant tissues due to their inherent physicochemical properties. The metal (loid)concentration in host sediments and their geochemical characteristics were also considered. This larger efficiency in the remediation of the plant was enhanced with the largest growth of bacteria in its rhizosphere. Mangrove plants can be used for pollutant stabilization, extraction, degradation, or volatilization. These different phytoremediation technologies including their applicability for various organic and inorganic pollutants can be used for cleaning environment with most suitable plant species. To further enhance the efficiency of phytoremediation, there is a need for better knowledge of the processes that affect pollutant availability, rhizosphere processes, pollutant uptake, translocation, chelation, degradation, and volatilization. In the present paper review for each of these processes what is known so far for pollutants, the remaining gaps in our knowledge, and the practical implications for designing phytoremediation strategies. Transgenic approaches can also be enhancing these processes. This plant based, low cost technology for the removal of the toxic contaminants could be extensively used for estuarine management to protect coastal regions for the removal of toxic pollutants.

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

DNA Sequencing Analysis for the Identification of *Plectranthus amboinicus* (Benth.) Species

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Abstract

DNA SEQUENCING ANALYSIS FOR THE IDENTIFICATION OF *PLECTRANTHUS AMBOINICUS* (BENTH.) SPECIES

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- **Objectives:**
  This study focused to identify and select specific bio molecular marker for identification of *P.amboinicus* species.
- **Introduction**
  DNA sequencing is an innovative molecular technique, in which short and agreed DNA sequences from either nuclear or/and cytoplasmic genome is used for rapid identification of biological specimen.
- **Methodology**
  The isolation of DNA from P.amboinicus by using CTAB method (Doyle & Doyle) and three different primer set (forward-reverse) of matK and two different set (forward-reverse) of rbcL primers were used for DNA sequencing analysis.

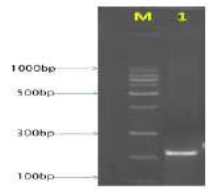
Morphology of *P.amboinicus*

List of Primers used for PCR amplification

S. No	Name of the Primer	Sequences
	matK-F	CCTATCCATCTGGAAATCTTAG
1	matK-R	GTTCTAGCACAAGAAAGTCG
	matK-F	CGATCTATTCATTCAATATTTC
2	matK-R	TCTAGCACACGAAAGTCGAAGT
	MatK-F	CCCRTYCATCTGGAAATCTTGGTTC
3	matK-R	GCTRTRATAATGAGAAAGATTTCTGC
	rbcL a-F	ATGTCACCACAAACAGAGACTAAAGC
4	rbcL a -R	GTAAAATCAAGTCCACCRCG
	rbcL -F	ATGTCACCACAAACAGAGACTAAAGC
5	rbcL-R	TCGCATGTACCTGCAGTAGC

- **Results**
  Based on DNA sequencing analysis, one set of matK primer (S.No:3) showed maximum amplification and sequencing success rate when compared to rbcL primer combinations.

Image of amplified PCR product



- ✓ **Conclusion**
  The DNA sequencing studies of matK Primers on the species of *Plectranthus amboinicus* provide valuable inputs to identify the active components and its development to potential drug in future

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Role of Mahim Creek Mangrove- Wetland Diversity

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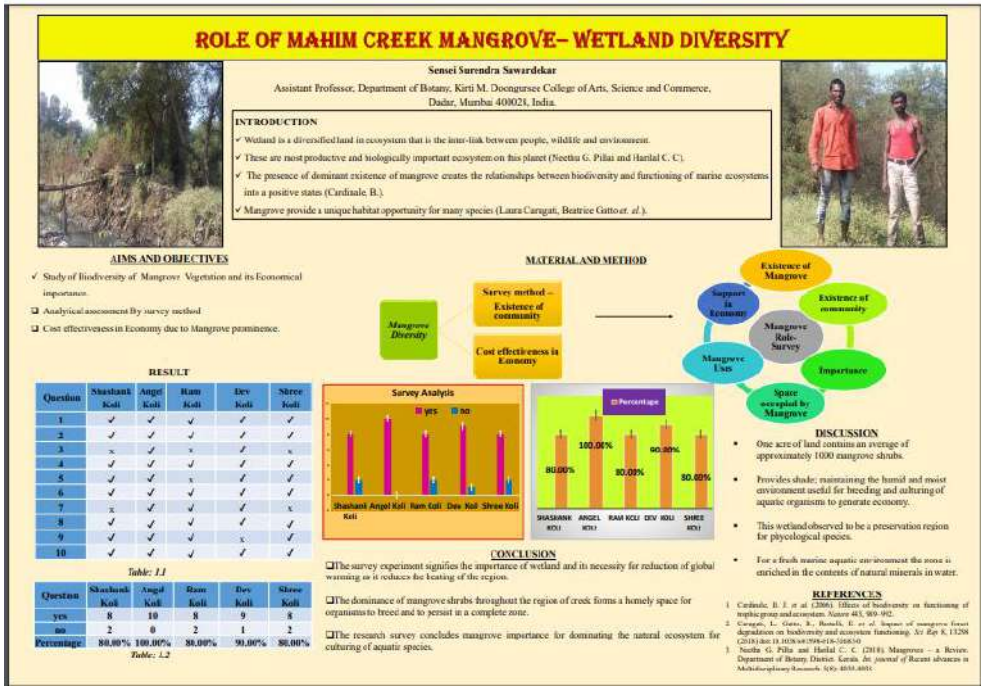
Abstract

The swamp regions consist of infinite resources filled with huge amount of microorganisms. The diversity of climatic conditions dominantly creates the sources for the living organisms to survive. Moreover the presence of prominent mangroves in these regions leads in generating reduction of atmospheric CO2 further creating a balance on a large scale. The current research attempt is completed by questionnaire survey methodology based upon the existence, economy, natural ecosystem support, space filled by mangroves and the role of mangroves in their daily livelihood. The survey method conducted, concludes a significance of the mangrove presence developing positive results on all categories of the questions analytically experimented for the role of Mahim Creek Mangrove –wetland diversity.

Poster



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Mangroves: A Symbiotic Link

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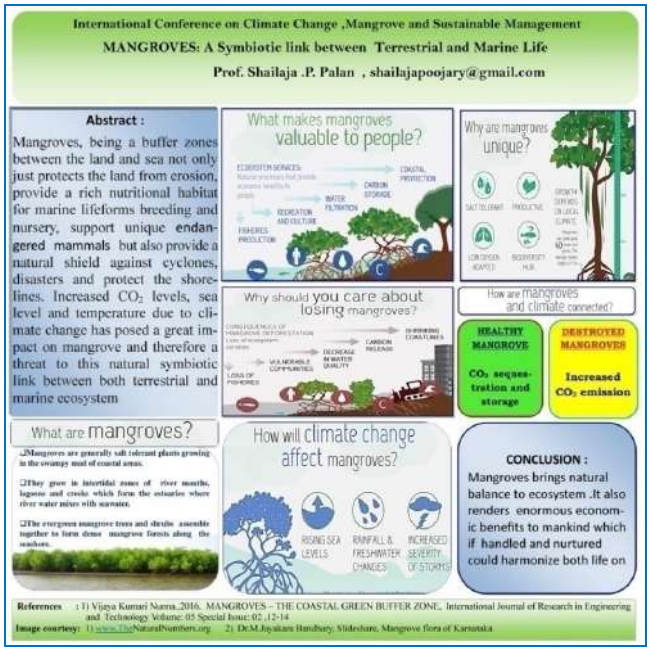
Abstract

Mangroves also called as Green buffer zone between the land and sea not only just protects the land from erosion, provide a rich nutritional habitat for marine lifeforms breeding and nursery, support unique endangered mammals but also provide a natural shield against cyclones, disasters and protect the shorelines. The nutritional abundance of this habitat along with its conducive environment provides a suitable habitat for many micro and macrofaunal species for partial or all through their life cycle. (Nagelkerken I.,2008)The decomposed organic matter from mangrove roots and the planktons in marine ecosystems play an important part of food web making symbiotic association .It has also been found to have a crucial role in averting coastline disasters (Nunna V.K.,2016)But increasing anthropogenic activities and elevated CO_2 levels, sea level and temperature due to climate change have been found to continually have damaging effects on mangrove vegetation. This thus, poses a great threat to this natural symbiotic link between both terrestrial and marine ecosystems. Mangroves bring natural balance to the ecosystem .It also renders enormous economic benefits to mankind which if handled and nurtured could harmonize both life on land and sea.

Poster



Climate Change, Mangrove & Sustainable Management

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Title

The Importance of Mangrove Wetlands ,Its Pollution, Threats

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Abstract The ecological value of mangrove is significant nodout. Not only the coastal protection but other important attributes justify the crucial role of ecosystem. However, the present status of mangrove in the country is alarming despite of legislation and efforts on the part of government.

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Conservation & Management of Aromatic Plants

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Abstract

The given piece of information is for particular challenges that Aromatic plant conservation and management raise at the global level, it is necessary to address issues pertaining their distribution and the environments where they grow. It is observe that aromatic plants studies from our region, I found that proportion of the reported aromatic plants had wide distributions in specific area, conservation and management interventions would be best served through collaboration between local people and experts. Aromatic plants are from a numerically large group of economically important plants. These are increasing demand for essential oils, aroma chemicals drugs and pharmaceuticals in the world market since two decades. Aromatic compounds are present in plants i.e. in root, wood, bark, foliage, flower, fruit, seed etc. In view of the steadily rising demands on these important natural resources, attention is important to the sustainable forms of production and utilization. Some aromatic plants are *Allium sativum, Menthaarvensis, Leonotisne pitifoliya, Anisomelis indica*.

Poster

Climate Change, Mangrove & Sustainable Management

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Title

Threats to the Mangrove Ecosystem and Its Conservation

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Abstract

The poster entitled 'Threats to the mangrove ecosystem and its conservation' exhibits various aspect regarding mangrove. Mangrove is tidally influenced wetland ecosystem within the intertidal zone of tropical and subtropical latitudes Mangrove influenced by fluctuation of temperature, Rainfall, Regular wind flow, Frost free, Radiation. There are two types of threats to mangrove which are a. Natural threats includes Climate change, Cyclones, Infestation by barnacles, Damage by Crustaceans, Insect pests such as woodborers, caterpillars, Drying of mangrove trees with this b. Anthropogenic threats include Tree felling for fuel wood and wood products, grazing by cattle, Reclamation for agriculture and aquaculture, urban development and Industrialisation. So there is prime need of conservation which is done by Afforestation, Legislation (including laws and policies), Monitoring and Surveys (land and aerial, etc.), Protection (including conservation, parks and reserves development, etc.). There are many precious Sustainable use of Mangrove ecosystem includes, Culture (Agriculture, Aquaculture -capture fisheries, culture fish), Natural products useful for medicinal purposes, drugs, etc.), other products (timber, salt production, honey, etc., Socio-economic aspects, Tourism, Traditional medicines etc. So save and conserve mangrove.

Climate Change, Mangrove & Sustainable Management

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Title

Mangrove Biodiversity In India

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Abstract

The term mangroves refer to an ecological Group of halophytic plant species which is Known as the salt tolerant forest ecosystem. The long coastlines and their mangrove vegetation have immense role in protecting coastal bio-diversity Mangrove ecosystem covered 47% world's mangrove area with 85% world's mangrove species from different habitats having an important role in coastal biodiversity of 30 countries that bordered the Indian Ocean. As many as 55 mangrove species belonging to 22 genera and 18 families have been recorded the Indian Ocean region. Mangrove ecosystems are rich in Biodiversity of Indian Mangroves diversity and harbour a number of floral and faunal species. Mangroves so act as nurseries for finfish, shellfish, crustaceans and molluscs. The Indian mangroves comprise approximately 59 species in 41 genera and 29 families. Of these, 34 species belonging to 25 genera and 21 families are present along west coast. There are about 25 mangrove species which have restricted distribution along the east coast and are not found on the west coast. Similarly, there are eight species of mangroves like *Sonneratia caseolaris, Suaeda fruticosa, Urochondra setulos* etc. Which have Biodiversity. There are hardly three to four species of mangrove which are rarely found along the Kerala coast. The associated mangrove flora is quite common to both the coasts, with minor variations in distribution. The floral diversity of mangroves of India is comprised of 38 core mangrove species

Climate Change, Mangrove & Sustainable Management

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Title

Present State and Future of the world's Mangrove Forests" - Blue carbon; Mangrove Forests Can Help Fight the Effects of Climate Change

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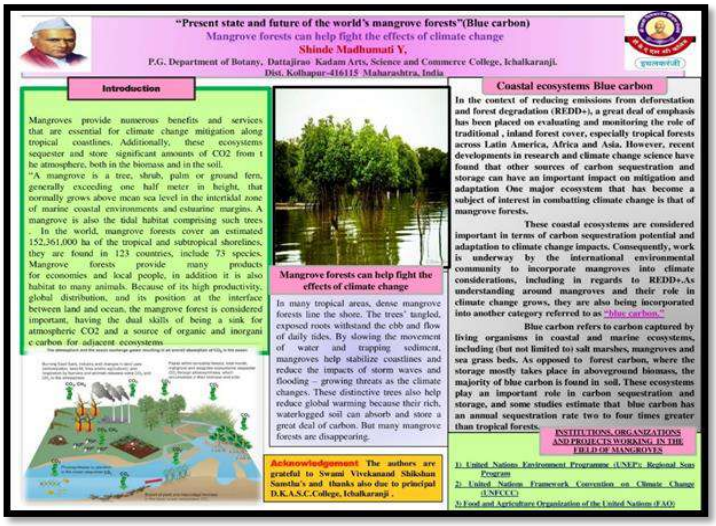
Abstract

In this chapter, we aim to describe the potential key challenges, applying management need to be improved reflect mangroves. By adopting a "carbocentric approach," Continue to be harvested unsustainably throughout most of the Earth's ecosystems. Recent research demonstrates that, the functional loss of predators could have far-reaching consequences on carbon cycling and, by implication, our ability to revolutionize climate change impacts. We discuss potential pathways by which trophic downgrading affects carbon capture, accumulation and preservation in vegetated coastal habitats. They are particularly well suited to the generation of carbon credits because of their unrivaled potential as carbon sinks, their resistance and resilience to natural hazards, and their extensive provision of Ecosystem. However, sufficient evidence to suggest that, critical to maintaining or growing reserves of 'blue carbon'(carbon stored in coastal or marine ecosystems), and policy and management need to be improved to reflect these realities. Blue carbon refers to carbon captured by living organisms in coastal and marine ecosystems.Carbon sequestration, primarily nursery areas for fish, water purification and coastal protection, to the benefit of local communities as well as to the global population. Ultimately the role that these systems play in climate change mitigation this means that issues of national and local governance, land ownership and management, and environmental justice are the main challenges that require careful planning at the early stages of mangrove to ensure successful outcomes and equitable benefit sharing within local communities.

Poster



Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Diversity of Mangrove species in East Coast of India

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Abstract

Mangroves are one of the most productive marine ecosystems on Earth, providing an exclusive habitat opportunity for many species and key goods and services for human beings. Mangroves are trees or shrubs that occur in intertidal areas and are a part of tropical coastal ecosystems. The Total Mangrove covers in the world is 150,000 sq. km and occur in 123 countries. South Asia comprises of 10,344 sq. km which is 6.8% of the world's mangrove cover. India's contribution is 45.8% of the total Mangrove cover in South Asia. Mangroves are dense and floristically diverse along the east coast of India and the Andaman and Nicobar Islands. Indian mangrove vegetation covers about 6,749 km2 along the 7516.6 km long coast line, including Island territories. The entire mangrove habitats are situated in three zones: (1) East Coast, about 4700 km2, (2) West Coast, about 850 km2, and (3) Andaman & Nicobar Islands about 1190 km2, with Lakshadweep Atoll. They are largely distributed States such as Tamilnadu, Andhrapradesh, Maharashtra, West Bengal & Odisha. The mangrove forest is a valuable resource throughout the tropics. Common Genus found in the region was Avicennia, Rhizophora, Heritiera and Exocoecaria. The forest products have plenty of traditional and direct usages as timber, firewood, charcoal, building materials, tannin and foods in the form of fish, crabs, prawns, molluscs and honey, benefits to not just the human population, but also plants, animals and supporting ecosystem.

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Title

Impact of Anthropogenic Activity on Mangrove and Coastal Ecosystem

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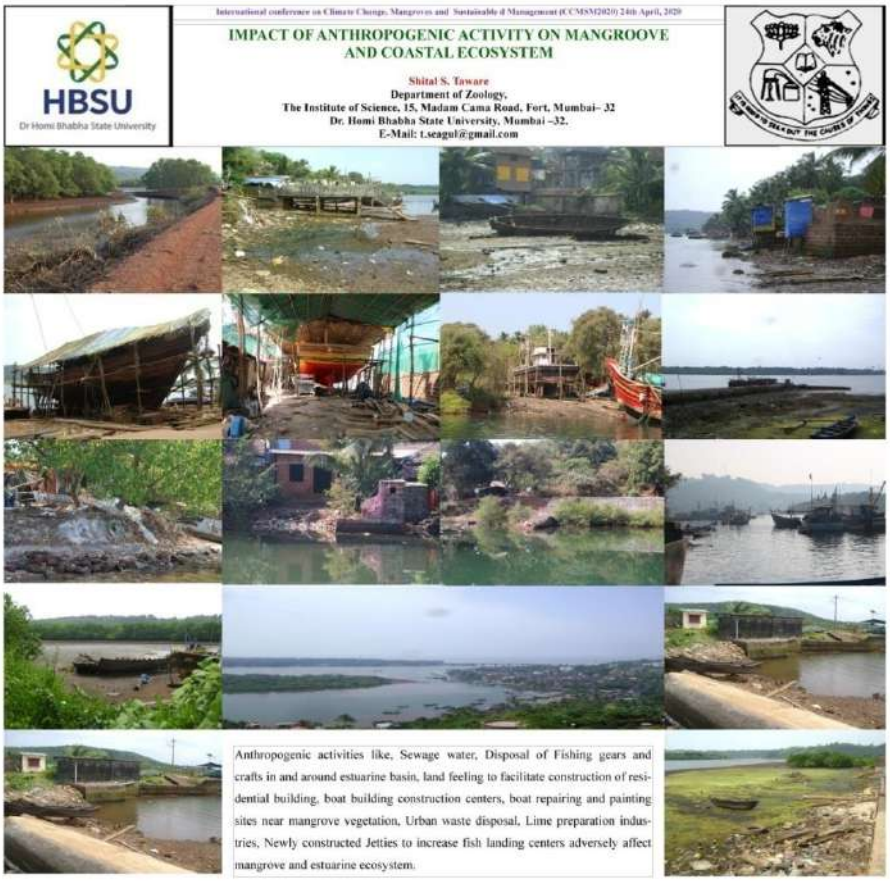
Abstract

Present study is based on visual observations of different anthropogenic activities in and around estuary and adjacent mangrove vicinity. These activities includes, Sewage water discharge, disposal of fishing gears and crafts, solid wastes dumping, waste from lime industries, cutting of mangroves for coastal road development and construction of residential buildings, new jetty construction to boost fishing activity, boat construction sites, cleaning and painting of fishing boats in intertidal zone of estuary and adjacent areas. These visual observations indicate increasing human population pressure and ultimate environmental degradation of estuary and mangrove ecosystem.

Poster



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Threats Drivers of Mangrove Loss

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Abstract

At the interface between coastal and terrestrial ecosystems, mangrove ecosystems comprise a wide array of unique habitats and thus support diverse terrestrial, estuarine, and marine species. However, in the past century, 67% of global mangroves have been lost due to drivers including coastal development, aquaculture, agriculture, and climate change. Restoring and conserving these vital ecosystems is key to sustaining both coastal communities and biodiversity. Because investing in mangroves has such wide-ranging benefits, their protection is a key pathway to development and climate goals. Mangrove ecosystems support diverse terrestrial, estuarine, and marine species, contributing to both food security and to local livelihoods by providing employment for coastal populations. An estimated 80% of global fish catches are directly or indirectly dependent on mangroves, making these forests important to ensure food security for local communities as well as globally.

Poster

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Biodegradation of Polycyclic Aromatic Hydrocarbon by Endophytic Bacteria of Mangrove

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Abstract

Mangroves are salt tolerant plants present at the interface zone between aquatic and terrestrial ecosystem. They have been described as 'tidal forest' and 'costal woodland' .These plants have a huge contribution in ecosystem and have great importance in economy as well. But mangroves are threatened plants and according to IUCN two mangrove species *Sonneratia griffithii* and *Bruguiera hainesii* are critically endangered species due to climate change and anthropogenic practices .Polycyclic aromatic hydrocarbon (PAHs) contamination occurs in costal regions , resulting in reduction of growth and reproduction rate, coating on aerial roots of mangroves .Endophytes are microorganisms that live within plant cells and help to promote plant growth , nitrogen fixation etc without showing any harmful effects on plants. Mangrove endophytes are able to degrade these PAHs (phenanthrene, pyrene) whether aerobically or anaerobically. Pseudomonas sp, Rhododcoccussp, Acinetobactersp have been reported to degrade these hydrocarbons. Genes of the endophytic bacteria that are responsible for these PAH degradation have also been identified at primary level .Natural processes to degrade these compounds and lowering the pollution level is not only important for mangrove ecosystem but also good for environment. A natural process is always better than any other artificial techniques. Biodegradation of these PAHs by endophytes of mangroves can be modified and improved with the help of molecular biology techniques.

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Title

Threats to Mangrove Ecosystem in Thane District, M.S. India

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Abstract

Mangrove is a shrub or small tree that grows in coastal saline or brackish water. Mangroves occur worldwide in the tropics and subtropics, mainly between latitudes 25° N and 25° S. The total mangrove forest area of the world in 2000 was 137,800 square kilometres (53,200 sq mi), spanning 118 countries and territories. Mangroves are salt-tolerant trees, also called halophytes, and are adapted to life in harsh coastal conditions. They contain a complex salt filtration system and complex root system to cope with salt water immersion and wave action. They are adapted to the low oxygen conditions of waterlogged mud. Mangrove forests move carbon dioxide "from the atmosphere into long-term storage" in greater quantities than other forests, making them "among the planet's best carbon scrubbers" according to a NASA led study based on satellite data. The major threats to mangrove forests include anthropogenic activities, population explosion, conversion to aquaculture ponds, clear-felling for timber, charcoal and wood chip production for industrial and urban development.Thane,is a culturally and aesthetically rich districts in Mumbai region. It is surrounded by a coastal line which spans neighbouring areas including Mulund, Kalva,Mumbra& Diva. Uptil the start of 21st century, Thane district had a canopy of magnificent flora in it. Mangroves uplifted its beauty and provided livelihood to the local inhabitants. However, urban development plans and various anthropogenic activities slowly and steadily had its toll and this beautiful ecosystem is now on the verge of extinction in this area. In the present investigation, an effort is made to highlight threats to mangrove ecosystem in this area, its impact on environment is studied and corrective measures for restoration are suggested.

Climate Change, Mangrove & Sustainable Management
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Title

Study of Ecotourism management with reference to Mangrove conservation in Versova region , Mumbai

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Abstract

Mangrove forests create habitats for diverse community of organisms that have considerable ecological and economical importance. Mangroves prevent coastal erosion by stabilizing sediments, creating nurseries and spawning areas for commercially important coastal fishes and shellfish species and provide stop-over sites for migratory birds. Presently the mangrove forests are under constant pressure due to rapid urbanization. In comparison with popular tourist destinations, coastal areas are most visited by tourists representing coastal tourism as one of the important economic activity. This also creates a major threat to the mangrove's richest and most fragile ecosystem. In today's world, major threats towards mangrove existence are climate change, population explosion, deforestation, marine pollution and over exploitation of natural resources. Considering the present needs for expansion of tourism industry against conservation of nature, Ecotourism is going to play a major role in terms of sustainable development, balancing both industrial growth and nature preservation. The selected study area is Versova region located at the north western Mumbai. The shores of the Versova creek area is surrounded by flourished Mangroves which supports different kinds of organisms especially molluscs, crabs and fishes. The present study focuses on the importance of Ecotourism as a sustainable solution for conservation of Mangrove forests surrounding the coastal areas. The study identified the scope of Ecotourism implementations for the conservation practices as well as creates a sustainable balance in terms of economical development to the local community.

Key words : Ecotourism, Mangrove conservation, Versova

Poster

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

A Study on The Isolation of Biofilm Producing Microorganisms and Characterization of Their Extracellular Polymeric Substances (EPS) From Sundarban Mangrove Area

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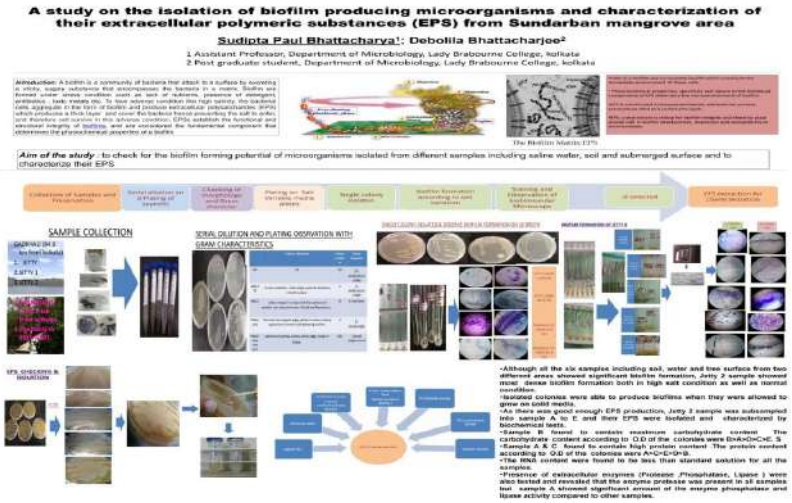
Abstract

A biofilm is a community of bacteria that are formed under stress conditions. The bacterial aggregate produce extracellular polymeric substances (EPS) forming a thick layer covering the bacteria, aiding the cell survive this adverse condition. EPS establish the functional and structural integrity of biofilms and are considered the fundamental component that determines the physiochemical properties of a biofilm. Naturalsamples were collected from mangrove areas of Sundarban and looked for their biofilm forming potential. Although isolates from all the six samples including soil, water and tree surface showed significant biofilm formation, Jetty 2 sample showed most dense biofilm formation even in high salt condition when allowed to grow on solid media. Due to good enough EPS production, Jetty 2 sample was sub-sampled into sample A to E and their EPS were characterized further biochemically. Sample B was found to contain maximum carbohydrate content whereas sample A & C had high protein content. The RNA content was found to be less than standard solution for all the samples. Presence of extracellular enzymes like protease,phosphatise and lipase were also tested. Although the enzyme protease was present in all samples, sample A showed significant amount of the enzyme phosphatase and lipase activity compared to other samples.

Poster



Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title **Importance of mangroves and its threats**

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Abstract

Mangroves are salt tolerant plants which are.highly sensitive and fragile. They are highly breeding and feeding for many marine organisms. They are having a wide variety of biodiversity and maintain and protect the shoreline of the coastal region. Nowadays increasing population causes many threats to these mangroves. Maintenance of water quality and clarity, natural habitat for endangered species as well as a good source of germplasm are some of the important features of mangroves. They stabilize the shoreline of coastal regions by slowing down erosion and provide natural barriers for coastal line protection.

In the present investigation the importance of mangroves and threats to mangroves are discussed. Different human activities regarding development leads to pollution, deterioration and grazing are major threats to mangroves. Along with these climatic changes, cyclones are some other threats to mangroves.

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

A Short Review on Mangrove Biodiversity

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Abstract

Throughout the world surface, mangroves reside less than 1% (Saenger, 2002) and are located around the tropical coastal line, more specifically, Tropic of Cancer and Tropic of Capricorn on all continents. In all 112 countries from tropical and subtropical segments show occupation of 18 million ha of mangroves. Most dense and diverse mangrove covering is located in South and Southeast Asia, which is around 41.4% of total world's mangroves distribution. India has 7,500 km extended coastal line which shows presence of 4461 km inhabitation of mangrove ecosystem. All the Indian coastal states, except island of Lakshadweep have mangrove covering which is 3.1 % of total world's distribution In India 29 families, 41 genera and 59 species were reported. West coast of India shows presence of 21 families, 25 genera and 34 species. East coast of India shows presence of 25 mangrove species which are localised in that area only, west coast doesn't show occurrence of these species. Gujarat, Maharashtra, Goa and Karnataka show 16, 20, 14 and 10 mangrove species respectively.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title **Threats to Mangroves Ecosystem**

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Abstract

Mangroves are native of swampy and saline coastal areas. They have ability to tolerate highly saline conditions. Their complex root system has ability to hold the sediments and prevents the erosion. Their roots acts as protecting barrier and controls the force of water from tides. They protect the coastal areas from hurricanes and floods and acts as real coastguards. Moreover, they provide shelter for many birds, fishes and animals species. Even though they greatly contribute to the environment by protecting it and providing habitat, there is a rapid decline and degradation of mangrove ecosystem. The major threats to mangrove ecosystem are climate change, pollution, and other anthropogenic activities such as urbanization, agriculture, and aquaculture. The oil spills, release of toxic chemicals in water, deposition of solid waste like plastic alters the respiration of their aerial roots and suffocates them. In most of the coastal areas, mangroves cover is destructed for plantation of rice paddies, rubber trees and for commercial production of shrimps and other fishes. Increase in coastal population has lead to cutting of mangroves forest for roads, buildings construction and for timber. This has resulted into severe destruction of mangroves and their associated flora and fauna. Hence, it is essential to take serious steps towards prevention of destruction and conservation of mangrove ecosystem.

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Impact of Mangrove Wetland Diversity

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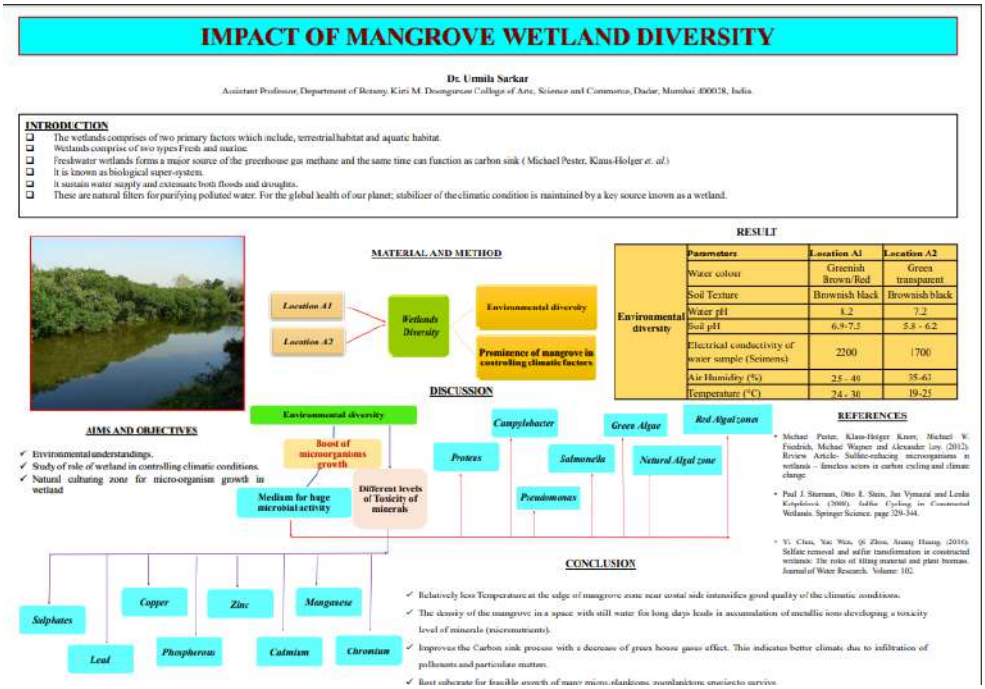
Abstract

Mangroves are well known for its presence in preserving the biodiversity of innumerable biological organisms. The presence of the mangrove is prominently found to be sustained in the region of damp-moist (swamp) places. The land and climatic characteristics is a typical feature that completely idealizes the region from the surrounding region in the atmosphere. The region of wetlands are filled with the migration of zoological species too. Since the sustainability of the available spaces provides a huge opportunity for every living organisms to build up good health and survival ability. The current research attempt is accomplished by experimenting the two locations of the wetland region containing mangroves. The two random locations was selected and the characteristics for colour, texture, EC, pH, temperature, and humidity was analyzed. The research concluded the importance of the mangrove wetland for identifying the good climatic conditions and carbon sink typicality. The study concludes future scope in research and development criteria to enhance the understanding of the mangrove wetlands.

Poster



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Ecological assessment of Mangroves: A case study from Gulf of Khambhat, Gujarat

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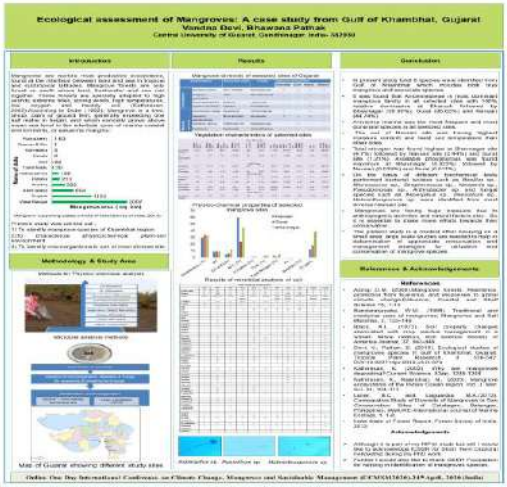
Abstract

Mangroves are world's most productive ecosystems, found at the interface between land and sea in tropical and subtropical latitudes. Mangrove forests are only forest on earth where land, freshwater and sea mix together. These forests are specially adapted to high salinity, extreme tides, strong winds, high temperatures, low oxygen and muddy soil. Present study focuses on the edaphic and microbial characteristics as well as the plant diversity in the study area. This study reveals the presence of 8 species in Gulf of Khambhat region. Avicenniaceae was the most dominant mangrove family in the region. Avicennia marina was most dominant species across all selected sites. Among all selected sites Navsari site was having more number of species of true mangroves as well as associate species. The soil of Navsari site was having highest moisture content and least soil temperature in comparison to other sites. On the basis of different biochemical tests performed bacterial isolates such as Bacillus sp., Micrococcus sp., Streptococcus sp., Neisseria sp., Pseudomonas sp., Arthrobacter sp. and three fungal species namely; Aspergillus sp., Penicillium sp., Helminthusporium sp. were identified from soil of most diverse Navsari site. The present study is a modest effort focusing on a small area; large scale studies are needed to help in determination of appropriate conservation and management strategies for utilization and conservation of mangrove species.

Poster



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Appliance of High Performance Thin Layer chromatography in Mangrove Herbal Technology

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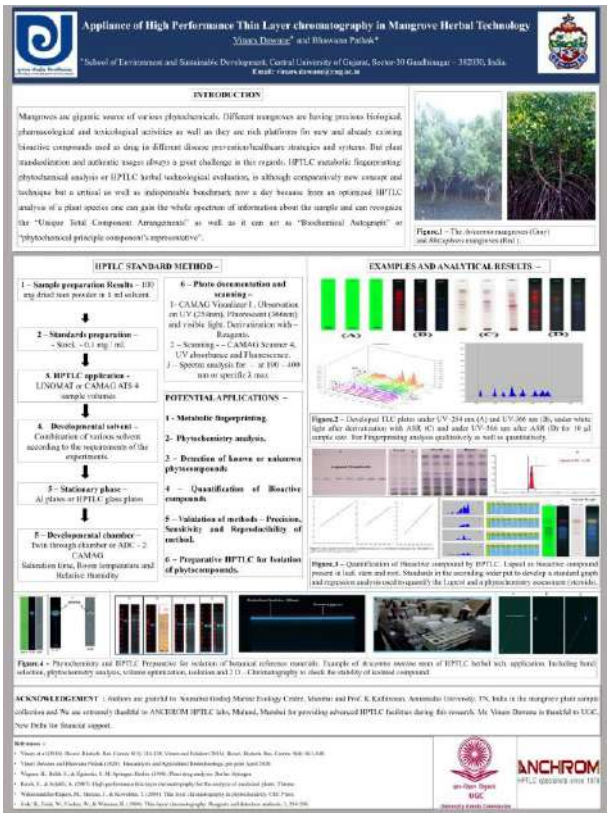
Abstract

The present poster highlighted the appliance of HPTLC as analytical tool for evaluation of herbal technological aspects for mangrove plants. The work examples included the evaluation of mangrove botanical reference materials from assessment of metabolic finger printing patterns qualitatively as well as qualitatively, secondary metabolic profiling, identification and quantification of specific bioactive compound as well as preparative HPTLC for isolation of compounds and 2D-chromatography technique to check its further purity and stability. Thus HPTLC found to be a remarkable tool for mangrove phytocompounds analysis.

Poster



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Mangrove, Conservation and Importance

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Abstract

Mangrove ecosystems are under threat from a changing set of pressures. Historically, the primary threats to mangroves have come from conversion for aquaculture or agricultural use, and cutting for timber. While these remain significant, new threats are emerging, including pollution, diversion of upstream water sources, offshore mining and land reclamation for development.

Mangroves: Survey responses from experts asked to choose up to three main threats to mangroves indicate that the main threat chosen was agriculture, representing both land conversion for agriculture and agricultural pollution. Aquaculture remains a primary threat as perceived by experts.

However, threats such as disruption of the water cycle and urban development received significant attention. Mangrove conservation efforts are largely aimed at preventing destruction of mangrove ecosystems, and increasing coverage. A key issue is not just destruction but degradation of mangrove ecosystems, through pollution, siltation, changes in salinity or loss of biodiversity. These aspects pose challenges for legal frameworks as well as assessment of outcomes, where it is easier to measure hectares than health of mangrove ecosystems.

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Avian Diversity of Sewri Mangroves Park, Mumbai, India

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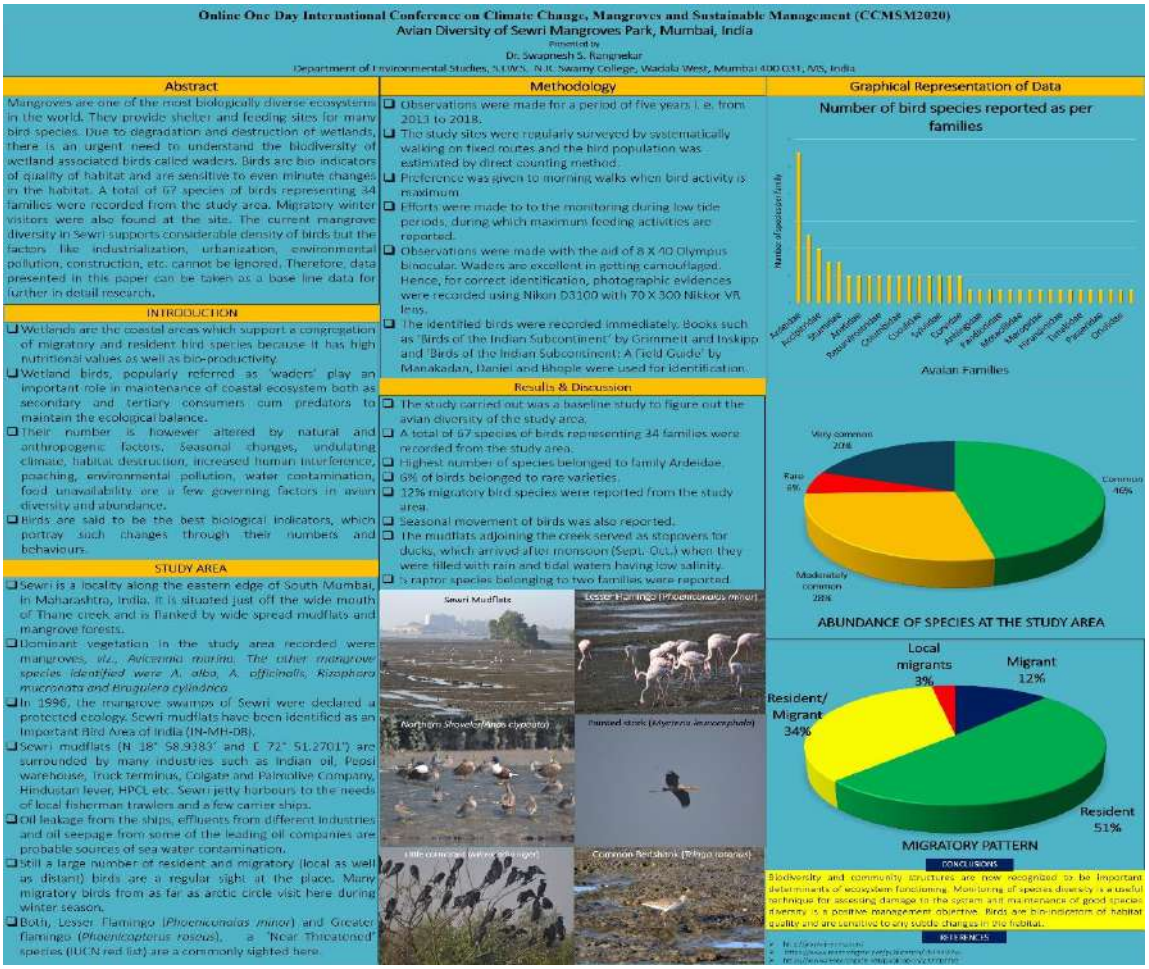
Abstract

Mangroves are one of the most biologically diverse ecosystems in the world. They provide shelter and feeding sites for many bird species. Due to degradation and destruction of wetlands, there is an urgent need to understand the biodiversity of wetland associated birds called waders. Birds are bio-indicators of quality of habitat and are sensitive to even minute changes in the habitat. A total of 67 species of birds representing 34 families were recorded from the study area. Migratory winter visitors were also found at the site. The current mangrove diversity in Sewri supports considerable density of birds but the factors like industrialization, urbanization, environmental pollution, construction, etc. cannot be ignored. Therefore, data presented in this paper can be taken as a base line data for further in detail research.

Poster



Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Mangroves ecosystem its threat and conservation

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Abstract

The mangrove refers to a wetland ecosystem within the intertidal zone of tropical and subtropical regions. The individual community of plants and animals associated with mangroves. Mangrove ecosystems are varied habitats with an unusual variety of animals and plant adapted to the environmental conditions of highly saline, soft bottomed anaerobic mud. The mangrove communities and may occur in terrestrial vegetation. The diversity of mangroves is high but the variety of mangrove ecosystems also makes is complicated to produce general principle Conservation and management of mangroves plants.

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Nature-Based Solutions for Ecosystem-Related Approaches

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Abstract The Nature based Solutions inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions. The Nature-based Solutions Initiative meanwhile defines them as actions that work with and enhance nature so as to help people adapt to change and disasters. With NBS, healthy, resilient and diverse ecosystems can provide solutions for the benefit of societies and overall biodiversity.

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Microbial Biodiversity in Sediment of Sundarban Mangrove Area

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Abstract

Sundarban Mangrove forest sediment harbors large and diverse group microorganisms, which include archaebacteria, eubacteria, cyanobacteria, algae and fungi. This ecosystem encompasses over 102 islands in the Indian side. Studies on microbiological status of sediments show that halophilic archaebacteria like *Halosarcina, Halorientalis, Halolamina, Halorussus, Halogranum, Haloferax, Haloplanus* etc. and methanogens like *Methanosarcina, Methanococcoides, Methanosalsum Methanogenium, Methanosaeta*, etc. are very common including the hyperthermophiles like Thaumarchaeota and Thermoplasmatales. A number of species under *Acidobacteria, Actinobacteria, Planctomycetes, Bacteroidetes (CFB), Firmicutes, Chloroflexi groups, Gemmatimonadetes* are predominant. On the other hand, due to the accumulation of organic pollutants, excess growth of *Oscillatoria, Lyptolyngbya, Phormidium of cyanobacteria and Oedogonium* and *Ulothrix* like filamentous algae cause eutrophication too. Among the filamentous fungi *Aspergillus* and *Penicillium* show their common occurrence as decomposers. Apart from their variety of environmental functions, all of these microbes play the direct role in mongrove ecosystem, biogeochemical cycle and in foodweb.

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Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Mangroves: The Tree of Life

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Abstract

Mangroves are considered as one of the most specialized ecological assemblages of halophytic plants acting as a transient zone between land and ocean. They comprise of taxonomically diverse shrubs and trees, distributed along tropical and sub tropical environments having specific habitats such as shores, estuaries, tidal creeks, backwaters, lagoons, marshes, mudflats and even at upstream points where water remains saline Mangrove forests are extremely important coastal resources, which are vital to our socio-economic development. Much of the ecological service of mangroves lies in protecting the coast from solar UV-B radiation, “green house” effects, and fury of cyclones, floods, sea level rise, wave action and coastal erosion. Mangroves contribute significantly to the global carbon cycle and produce large amounts of litter in the form of falling leaves, branches and other debris. Besides, mangrove habitats contribute to complex food webs and energy transfers. This poster is a review work on conservation, ecological functions and economic benefits of mangroves, and is based on published reports. Considering their value for the environment and coastal communities, mangrove conservation should become a priority and efforts must be invested to find new and successful methods for conserving mangrove ecosystems.

Poster

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Mangroves of Maharashtra Coast

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Abstract

The Maharashtra coastal length is estimated about 720 kms and extends between the latitude 15 52'N and 20 10'N and longitude 72 10'E and 73 10'E which is characterized by several pocket beaches flanked by rocky cliffs. It falls under five districts from South to North 1) Thane District, 2) Sindhudurg District, 3) Ratnagiri District, 4) Raigad District & 5) Mumbai District. Due to constant anthropogenic pressure during the last 25 years there is about 40% gradual degradation and reduction of mangrove area in the Maharashtra coast especially in thane district. According to satellite Imagery data the mangrove area in Maharashtra coast is only 148.4 km2 on the mouth of rivers like the Vashishti, the Thane, the Vaitarana followed by the minor areas are Dharamtar, Elephanta Island, Mahim, Mumbai, Raigad, Rajapur, Ratnagiri, Shastri, Sindhudurg, Thane, Vasai (Ullhas), Vikroli, Waghotan etc. Mangroves are growing in the swampy mud of coastal areas including intertidal zones of river mouths, lagoons and creeks which forms the estuaries where the river water mixes with sea water. Mangroves are salt tolerant plants adapted to survive in salt rich, oxygen poor soil that is periodically flushed by tides due to many biological adaptations like buttress roots, pneumatophores, salt filtering roots, salt glands, stilt roots, lenticels etc. In Maharashtra at present there are 20 species of mangroves belonging to 15 genera and 11 families. Based on different salinity range there are three category of mangroves viz., 1) High salinity mangroves e.g. *Acanthus ilicifolius,, Bruguiera cylindrica, Excoecaria agallocha, Rhizophora apiculata, R. mucronata, Sonnaratia alba; 2)* Medium salinity mangroves e.g. *Aegiceras corniculata, Bruguiera gymnorhiza, Kandelia candel and 3)* Low salinity mangroves *e.g. Acrostichum aureum, Sonneratia caseolaris*

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title

Distrbution of Mangrove in India and their benefits

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Abstract

A **mangrove** is a shrub or small tree that grows in coastal saline or brackish water. The term is also used for tropical coastal vegetation consisting of such species. **Mangroves** occur worldwide in the tropics and subtropics, mainly between latitudes 25° N and 25° S.

Distribution of mangrove forest in India :_

Sunderbans Mangroves, Godavari-Krishna Mangroves, Baratang Island Mangroves, Pichavaram Mangroves. Are the most dens mangrove for forest in India.

Benefits of Mangroves

Fisheries: Mangrove forests are home to a large variety of fish, crab, shrimp, and mollusk species.

Timber and plant products Mangrove wood is resistant to rot and insects, making it extremely valuable.

Coastal protection : The dense root systems of mangrove forests trap sediments flowing down rivers and off the land

Tourism: Given the diversity of life inhabiting mangrove systems, and their proximity in many cases to other tourist attractions such as coral reefs and sandy beaches, it is perhaps surprising that only a few countries have started to tap into the tourism potential of their mangrove forests.

Poster

Sr. No.	States / UTs with Highest Mangrove cover 2013	Total Mangrove Cover in Sq. km.
1	West Bengal	2,097
2	Gujarat	1,103
3	Andaman and Nicobar Islands	604
4	Andhra Pradesh	352
5	Odisha	213
6	Maharashtra	186
7	Tamil Nadu	39
8	Goa	22
9	Kerala	6
10	Karnataka	3

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Assessment of plant diversity, heavy metal accumulation and sustainable utilization of Mangroves forest of West-southern part of the Gujarat

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Abstract

Mangroves forest serves as interface between land and sea. These are most productive, good bio-indicators of environmental quality and health of any coastal ecosystem, protects soil erosion and long term carbon sink as carbon storing or carbon sequestration. Besides of these they serve as valuable nursery as well as commercial and recreational fishing industries. They support threatened and endangered species so that they also serve as tourism purpose. Mangroves are utilized as renewable resources. The production, transport and combustion of charcoal constitute a critical energy and economic cycle in the economies of rural village. Present study was conducted in mangroves forest region in Gulf of Khambhat for analysis of plant species diversity, heavy metal contaminants, Physico-chemical characterization and how these forests directly affect the economy of rural community. Result of our study shows that occurance of 4 plant species (Avicennia marina, Avicenna alba, Sonneratia apetala, Acanthus ilicifolius) in this region. Major heavy metal contaminants Fe, Mn, Sr, Ti, Tl, Cd, Cr, Ni, Pb, Sb, V, Zn, Co, Li, Ca and Mg were found within permissible limit of international standards. Field survey results shows 61.43% and 53.57% of human population depend on these mangroves for animal fodder and fishing respectively.

Poster

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Decolorization of methyl red dye using Avicennia marina bark as biosorbent

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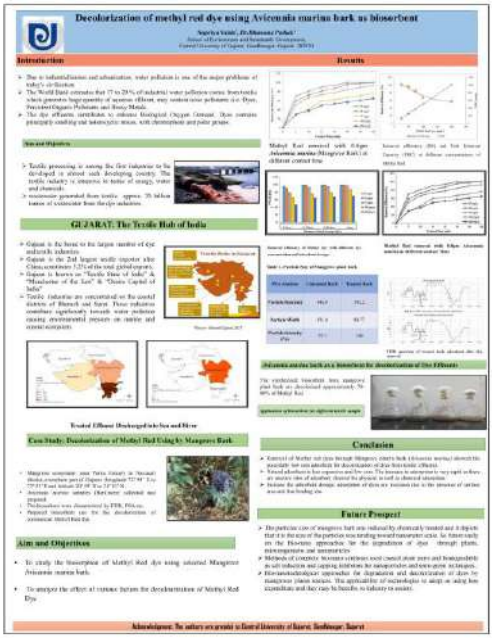
Abstract

Mangroves are the series of shrubs and small trees having greater tolerance against salt concentration. Mangroves are having very rich diversity of plants with medicinal benefits, source of wood, large CO2 sequestration property. Dyes are the important class of organic pollutants and effects was hazardous for human beings and its life process. The main focus of this research was to analyze the adsorption mechanism of acidic dye through treated by chemical and untreated mangrove bark. The Avicennia marina barks, and natural mangrove plant was obtained from the Purna estuary, Navsari, Gujarat. The bark powder was pretreated in formaldehyde solution in an acidic medium for the preparation of natural adsorbent to use for the decolorization of Methyl Red dye. At room temperature (30 ± 2) ºC the batch adsorption studies were work efficiently to degradation of dye on to bark of Avicennia marina. Although another factors that affects the batch experiments are pH, reaction time, dyes concentrations, and adsorbent amount dose and getting results are favorable. The decolourization of methyl red dye through Mangrove bark (Avicennia marina) showed the potentially low cost adsorbent to decolorization of dyes from textile wastewater.

Poster



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Threats to Mangrove Ecosystem

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Abstract

The universal cause of the destruction are shrimp culture, wood chip and pulp industry, urban development and human settlements and domestic uses for timber, firewood and fodder. In dry areas, grazing by buffaloes,sheep, goats, camel can also lead to destruction of mangroves. Sundari (Heritiera fomes), being a freshwater loving mangrove floral species could not withstand this rising salinity of the ambient water and gradually vanished from the region. In some key countries like Indonesia, which has the world's largest intact mangroves, the projected rate of loss is even higher with 90 percent loss in some provinces like Java and Sumatra (Bengen and Dutton, 2003). During the last two centuries, the highly productive mangrove ecosystems have been destroyed or degraded very rapidly. Although mangrove ecosystems have tremendous value for coastal communities and associated species, they are being destroyed at alarming rates. Over the last 50 years, about one-third of the world's mangrove forests have been lost (Alongi, 2002). Human threats to mangroves include the overexploitation of forest resources by local communities, conversion into large scale development such as agriculture, forestry, salt extraction, urban development and infrastructure, and diversion of freshwater for irrigation (UNEP, 1994). The greatest human threat to mangroves is the establishment of shrimp aquaculture ponds.

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Mangroves Biodiversity – The Coastal Ecosystem

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Abstract

Mangrove forests are among the most gainful and naturally significant biological systems since they give products and ventures to human culture. Mangroves are salt-lenient plants of tropical and subtropical intertidal districts of the world. The particular areas where these plants happen are named as 'mangrove environment'. The appropriation of mangrove biological system on Indian coastlines demonstrates the Sundarban, Andaman-Nicobar Islands, Goa and Gulf of Kutch in Gujarat. Mangroves shield shorelines from harming tempest and tropical storm winds, waves, and floods. Mangroves likewise help forestall disintegration by settling dregs with their tangled root frameworks. They keep up water quality and clearness, sifting contaminations and catching residue starting from land. Mangroves give fundamental environment to a huge number of animal groups, they additionally fill in as reproducing and nursing justification for marine finfish and shellfish types of business significance. Mangroves, including related soils, could sequester roughly 22.8 million metric huge amounts of carbon every year. Covering just 0.1% of the world's mainland surface, the woodlands represent 11% of the absolute contribution of earthbound carbon into the sea and 10% of the earthbound broke down natural carbon (DOC) sent out to the sea.

Significance of Mangroves:

Mangroves goes about as kidneys for the waterfront waters, Important nursery reason for finfishes and shellfishes, Renewable asset of fuel, Offers assurance against beach front disintegration, Play significant job in business of Coastal people group, Mangrove foliage as feed for household creatures, Provide open doors for Tourism, Education and Scientific Study.

Key words: - Shorelines, Coastline, Storm

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title **My Critical observation of Mangrove Forest of Andaman Island**

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Abstract Post visit to picturesque Andaman, my observations with reference to factors influencing loss of Mangroves in Island shores because of Human intervention is hereby highlighted. Lot of construction activities is carried on very close to sea coasts for commercial purposes like Hotels and Shops along with Roads leading to these dwellings. Local Food needs lead to Development of Agricultural fields along coastal belt further add to Mangrove degradation. Tourists in particular engage themselves in activities like water sports, scuba diving, snorkeling and undersea walking etc. results in destruction of Mangrove vegetation. Some unlicensed scuba diving personnel along with tourists contaminate coasts with waste and disposables. Motor boats used for fishing and water sports like speed boat ride etc harboring near mangrove forest drastically disturbed flora as they spill oil. Excessive exploitation of mangroves could result in lower litter production and consequently could affect productivity of coastal fisheries. Mangroves have a tremendous coastal protection. Therefore Government should restrict and control all these activities for preserving natural resources.

Poster

Fig:1. Pneumatophores of *Avicennia* Species in Oil spills near Motor Boat Harbor

Fig:2. Human Activities in Sea shore of Andaman

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title **Positive Effect Of Climate Change On Animals During COVID-19 Lockdown**

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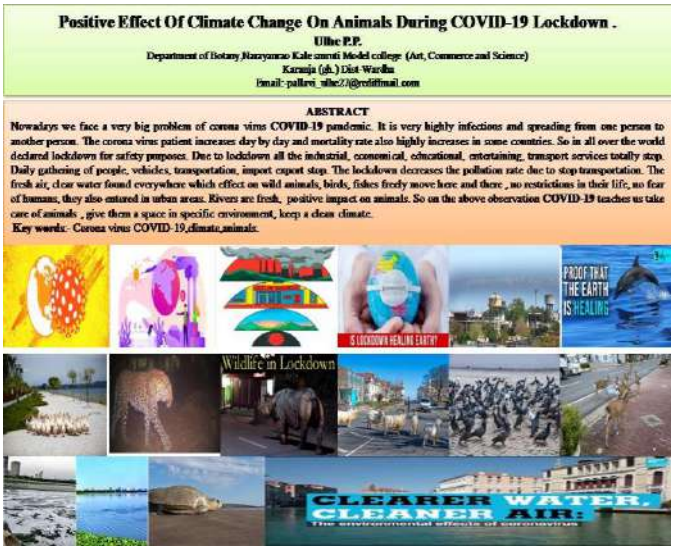
Abstract Nowadays we face a very big problem of corona virus COVID-19 pandemic. It is very highly infectious and spreading from one person to another person. The corona virus patient increases day by day and mortality rate also highly increases in some countries. So in all over the world declared lockdown for safety purposes. Due to lockdown all the industrial, economical, educational, entertaining, transport services totally stop. Daily gathering of people, vehicles, transportation, import export stop. The lockdown decreases the pollution rate due to stop transportation. The fresh air, clear water found everywhere which effect on wild animals, birds, fishes freely move here and there, no restrictions in their life, no fear of humans, they also entered in urban areas. Rivers are fresh, positive impact on animals. So on the above observation COVID-19 teaches us take care of animals, give them a space in specific environment, keep a clean climate.

Poster



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Manakudy Mangrove Ecosystem of Kanyakumari District, Tamil Nadu India

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Abstract

MANAKUDY MANGROVE ECOSYSTEM OF KANYAKUMARI DISTRICT, TAMIL NADU INDIA

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INTRODUCTION

A mangrove is a shrub or small tree that grows in coastal saline or brackish water. The term is also used for tropical coastal vegetation consisting of such species. Mangroves occur worldwide in the tropics and subtropics, mainly between latitudes 25° N and 25° S.

CONSERVATION OF MANGROVES

The mangroves are valued for its protection and stabilization of low-lying coastal lands and its importance in estuarine and coastal fisheryfood chains. Mangroves are flood buffers and they also help in stabilizing the climate by moderating temperature, humidity, wind and even waves.

MANGROVE GOVERNANCE

Mangrove conservation efforts are largely aimed at preventing destruction of ecosystems and increasing coverage. A key issue is not just destruction but degradation mangrove ecosystems through pollution, siltation and changes in salinity or loss of biodiversity.

STUDY AREA

The sampling site of birds observed from

Plate: 1 Mangrove – Manakudy Estuary

Manakudy mangrove have an average depth of about 3 – 4 m with a gradual shallowness towards the fringes of the wetland is selected (Plate: 1).

DATA COLLECTION AND ANALYSIS

Data collection was carried out for 5 ha/day from 06:30-10:00 a.m. in the morning and from 4:30 to 06:00 p.m when the activities of birds were prominent. Photographs were taken to justify the species type for those species which were difficult to identify. The birds were identified with the help of Ali and Ripley (1993). Shannon-Weaver Diversity Index was calculated in order to know the species diversity based on the abundance of the species by the following formula given by Shannon and Weaver, 1963. Where S is total number of species and H' is the Shannon-Weaver diversity index for the statistical analysis PAST version 2.17C was used (Hammert *et al.*, 2001) to find out the Simpson diversity, Shannon diversity (H), Evenness (E), Margalef, 1993 (R) and Dominance.

RESULT

The avian species varied from 10 observed during summer evening to 66 in monsoon morning and avian individuals varied from 35 in summer evening to 2435 during summer morning (Table: 1) highlights the importance of Mangroves and need to conserve the habitat.

Table: 1 Observation of Avian species Diversity observed during monsoon and summer seasons

S. No.	Season	Observance	No. of species	Individuals	D	H'	H'/H' ax
1.	Monsoon	Morning	66	1585	0.95	3.53	0.51
		Evening	20	41	0.92	2.82	0.83
2.	Summer	Morning	64	2435	0.96	3.70	0.63
		Evening	10	35	0.83	2.07	0.79

Water is essential for the survival of all living organisms, though its accessibility is extremely low of 1.370 million km^3. The physico-chemical analysis of Manakudy Mangrove is observed and tabulated.

Table -2 Physico-chemical Parameters of Manakudy Mangrove

Parameters	October 2019	November 2019	December 2019	January 2020	February 2020
pH	7.7-8.4	6.2-8.4	7.4-8.3	7.5-8.1	7.2-8.5
Temperature	34.0±2.9	33.50±2.5	33.0±2.2	32.0±2.2	31.75±2.0
Turbidity	2.50±0.5	1.50±0.5	1.25±0.5	2.00±0.81	2.75±0.5
TDS	321.25±11.8	315.25±6.19	519.25±20.82	510.75±20.81	511.50±19.79
T. Alkalinity	198.50±5.9	208.75±16.5	270.00±11.37	281.25±11.93	226.25±2.5

CONCLUSION

The investigation of physico-chemical parameters showed pH favours the growth of living organism. The species composition of birds observed during monsoon and summer seasons revealed us to conserve mangroves habitat for globally threatened avian species. Mitigation measures must be implemented for sustainable conservation to save the natural resources.

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Insights into Mangrove Ecosystem-An Overview

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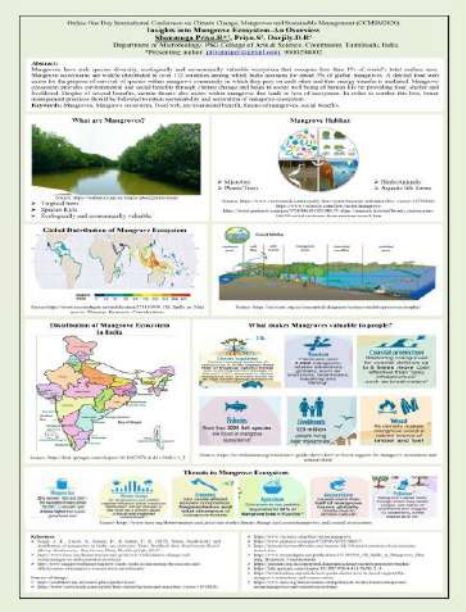
Abstract

Mangroves have rich species diversity, ecologically and economically valuable ecosystem that occupies less than 1% of world's total surface area. Mangrove ecosystems are widely distributed in over 112 countries among which India accounts for about 3% of global mangroves. A detrital food web exists for the purpose of survival of species within mangrove community in which they prey on each other and thus energy transfer is mediated. Mangrove ecosystem provides environmental and social benefits through climate change and helps insocial well being of human life by providing food, shelter and livelihood. Despite of several benefits, certain threats also exists within mangrove that leads to loss of ecosystem. In order to combat this loss, better management practices should be followed to retain sustainability and restoration of mangrove ecosystem.

Keywords: Mangroves, Mangrove ecosystem, Food web, environmental benefit, threats of mangroves, social benefits.

Poster



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Studies of Some Coastal Ecosystems of Western Maharashtra (India)

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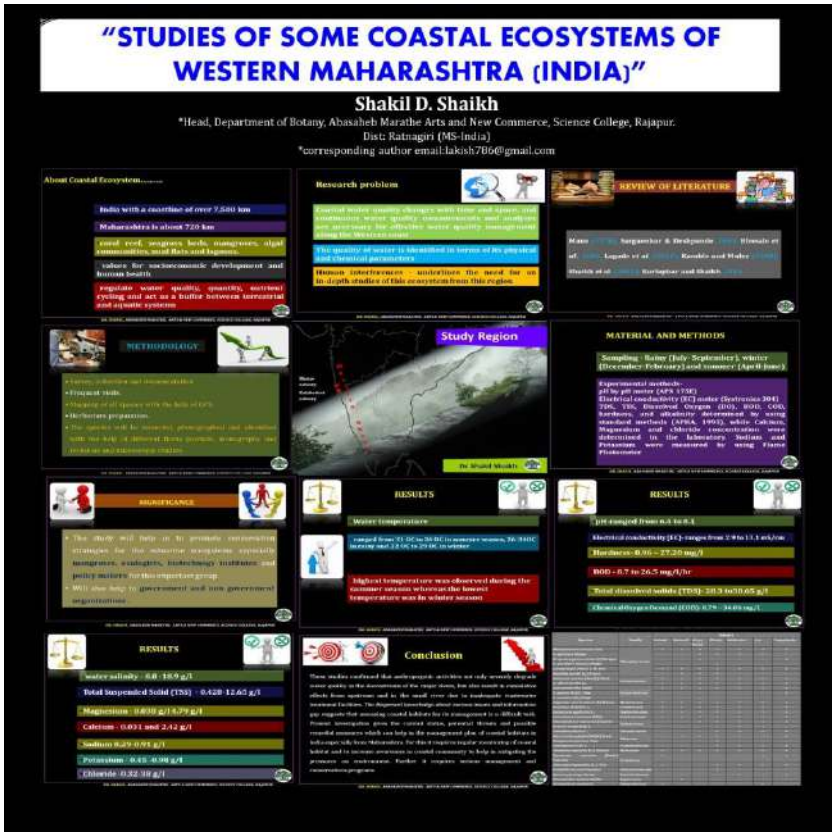
Abstract

In the present report attempt is made to study of the mangrove species of Wstern Maharashtra and its analysis with respect to hydrological and distribution of the species along the coast. Mineral composition of various estuaries varies at each locality which can be correlated with distribution of species. The study indicates ecological importances with its microclimatic studies, water analysis and soil analysis.

Poster



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title **Mangrove Ecosystem: Importance**

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Abstract Mangroves are those plants that thrive along coastlines, lagoons and estuaries in the tropical and sub-tropical regions. Mangroves significantly facilitates in moving organic matter and energy from the land to marine ecosystem. Mangroves plays a crucial role as nature's shield against cyclones, natural disasters and protects shorelines. Mangroves make significant socio-economic and environmental contributions as they protect the coastal and inland areas from severe conditions like erosion, wind, waves, water currents and tsunamis. It acts as breeding and nursery grounds for a variety of marine animals. Coastal peoples dependent on mangroves for fishing. In particular, mangroves are important for fisheries, coastal protection, timber and fuel, Tourism, carbon storage and water purification.

Key words: Ecosystem, Socio-economic, Importance, Mangroove.

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title **A study on variation of physico-chemical and hydrobiological parameters with respect to environmental and anthropogenic factors in a high, moderate and less productive pond of Bankura district of West Bengal**

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Abstract Bankura district is commonly known as 'Laal Paharir Desh' (the land of red hills). It is located towards the southwestern part of the state West Bengal. Being an endemic land of lateral and alluvial soil, the climate of this district ranges from arid to semi-arid. As a result, water scarcity is a major problem for the inhabitants of this district, especially during the summer. To overcome the problem of water crisis, district Bankura is full of static water bodies like pond, reservoir and water tank etc. from the past. But, maximum of them (especially in the town) are either eutrophied or infected by a dreadful condition during the summer called 'red tide'. On the other hand, pisciculture is an important factor for economical development of Bankura district, which is one of the backward districts of West Bengal. Still Bankura has ranked first in pisciculture (particularly in spawn production) within West Bengal (According to the Office of the Additional Director of Fisheries, Bankura, West Bengal, India; www.bankura.org.in/site/Fisheries.htm). As we know that the zooplanktons are the connecting links between autotrophs and heterotrophs and it's density is also directly correlated with pisciculture potentiality so, it is necessary to maintain proper zooplankton community to grow the yield of any pond. In this present study we have tried to find out the causes of fish mortality and variation of yield (fish production) of some ponds of Bankura town in relation to various physico-chemical and hydro-biological (plankton) parameters. Also we tried to study the availability of plankton when a pond is less, moderate and high productive with respect to physico-chemical characters at various times of the day.

Key words: Bankura town, phytoplankton, zooplankton, physico-chemical parameters.

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title **Mangroves Conservation and Ecosystem Services**

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Abstract Mangrove forests constitute the most productive and biologically diverse ecosystem on the planet. The mangroves have immense value to local communities. The importance of restoring and protecting mangroves is reflected most clearly in Sustainable Development Goals which focuses on sustainable management of oceans and coasts. But restoring mangrove forests also supports the achievement of many other SDGs, including eliminating poverty and hunger ensuring livelihoods and economic growth taking actions against climate change impacts and halting biodiversity loss. The present study mainly focused the correlation between mangrove conservation and ecosystem. It is necessary to strengthen resilience and adaptive capacity to climate-related changes and natural disasters in the world. This initiative aims to promote the conservation of mangroves, to value these ecosystem goods and services, to address economic issues, and to emphasize the cultural, social and spiritual aspects of mangroves. The sustainable harvest of mangrove products for market sales can create valuable business for local communities and small scale food producers. The women and weaker sections of society enjoy gainful livelihood opportunities. Social and political action groups are necessary to achieve Sustainable Development Goals. The existing mangrove protection efforts of the stakeholders should be strengthened on the basis of establishment of a joint online platform, development of regional networks and collaborative approaches. Mangroves forests are productive and species rich hubs for marine life. The restoration of mangroves leads to regaining extremely productive ecosystems which provide breeding and nursery grounds and ideal habitats for a variety of plants and animal species.

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title

Study of Threats to Mangroves Ecosystems

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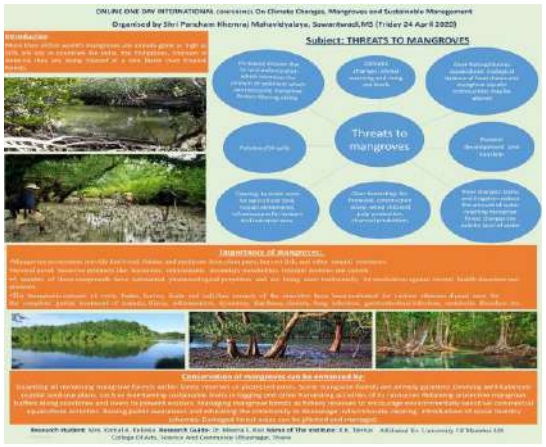
Abstract Mangroves play a vital role in many aspects of human life (e.g., therapeutic uses involving treatment for malaria, diarrhea, ulcer, skin infections, diabetes and snake bite) but these ecosystems are vulnerable to human activities and climate change. In some coastal areas mangrove ecosystems are converted into farm lands, resorts and aquaculture. Loss of mangroves is also a consequence of climate change, e.g., rise or fall of sea level changing pattern and magnitude of cyclone, rainfall intensity and shoreline erosion Natural phenomenon have a lesser threat to mangrove ecosystems than human interventions. Species diversity has decreased in many regions due to exploitation of coastal areas. Mangrove ecosystems support essential ecological functions, so significant losses of mangrove forests will have irreparable consequences. Mangrove forests intercept land-derived nutrients, pollutants, and suspended matter before these contaminants reach deeper waters. They export materials that support near-shore food webs, including shrimp and prawns. These natural subsidies are provided to us in addition to various extractive benefits including wood, timber, charcoal, honey, tannins, salt, etc. Anthropogenic activities clear the area of mangroves for agricultural, industrial, and urban development. This study focuses on such activities which are a threat to the mangroves along with the climatic changes.Therefore, it is important to generate awareness regarding beneficial aspects of mangroves and implementation of a proper management strategy to protect these habitats from further destruction.

Poster



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title **Role of Sulphur Oxidizing Bacteria in the Mangrove Ecosystem**

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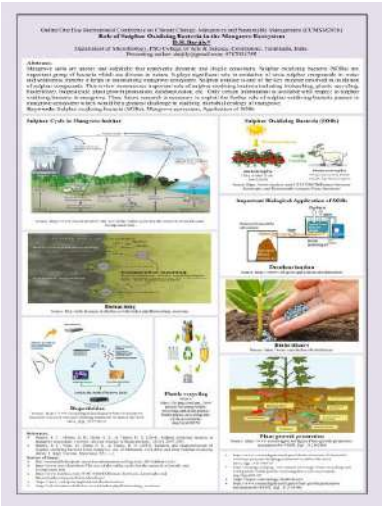
Abstract Mangrove soils are anoxic and sulphidic that represents dynamic and fragile ecosystem. Sulphur oxidizing bacteria (SOBs) are important group of bacteria which are diverse in nature. It plays significant role in oxidation of toxic sulphur compounds in water and sediments; thereby it helps in maintaining mangrove ecosystem. Sulphur oxidase is one of the key enzymes involved in oxidation of sulphur compounds. This review summarizes the important role of sulphur oxidizing bacteria including bioleaching, plastic recycling, biofertilizer, biopesticide, plant growth promotion, deodourization, etc. Only certain information is available with respect to sulphur oxidizing bacteria in mangrove. Thus, future research is necessary to exploit the further role of sulphur oxidizing bacteria present in mangrove ecosystem which would be a greatest challenge in studying microbial ecology of mangrove.

Keywords: Sulphur oxidizing bacteria (SOBs), Mangrove ecosystem, Application of SOBs



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title **Mangrove Forest Covers in India and Need for Their Conservation**

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Abstract Mangrove forests comprise of various species of mangroves which are tropical trees and shrubs that grow along coastlines, wetlands and river banks in many parts of the earth. Mangroves are the most productive ecosystems. These are also biodiversity hotspots. They are economically as well as ecologically valuable. As per the ISFR 2017 report, the total area of mangrove cover of India is 4921 km. The mangrove forests are located in various states of India such as Gujarat, Maharashtra, Kerala, Karnataka, Tamil Nadu, Andhra Pradesh, Orissa, and West Bengal. They also span the regions of union territories, Goa, Andaman and Nicobar Islands. Sundarbans which is located at the lower end of Ganges delta in West Bengal is the largest mangrove forest in World. Pichavaram mangrove situated in Tamil Nadu contributes major mangrove forest area in India. Mangroves provide a unique ecological niche to diverse group of microorganisms as well as organisms associated with the mangrove ecosystem. Mangrove provides many advantages such as providing home to various species, being source of food web, providing various resources such as medicines, fuels, secondary metabolites to humans. They act as buffer zones by forming protective barriers against flood and erosion. But since past years the mangrove covers in India are threatened due to various anthropogenic activities. There is decline in the mangrove covers. Due to the disturbed mangrove area, there is loss of biodiversity where most of the marginalized species reside. Their destruction also contributes to loss of useful resources. Hence, they have to be protected, restored and conserved.

Poster

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title **Joining Hands To Conserve Mangroves**

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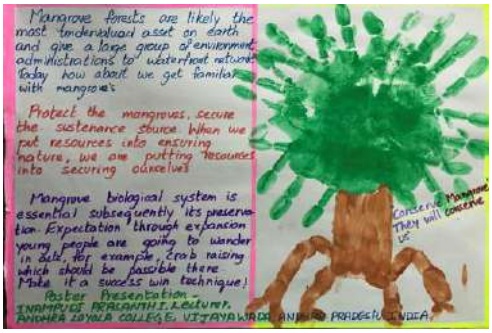
Abstract Mangroves are unique ecosystems occurring along the sheltered inter-tidal coastlines, mudflats, riverbanks in association with the brackish water margin between land and sea in tropical and subtropical areas*joining their hands for human welfare*. They sustain diverse flora and fauna species in large proportion and provide many ecosystem services such as coastal protection from storm, reduction of shoreline and riverbank erosion, stabilizing sediments and absorption of pollutants.Yet despite their importance, mangrove forests are under threat. Over a third have already disappeared, In addition to climate change and pollution, there are also local threats. These include overharvesting of wood for fuel and construction, dams and irrigation that reduce the flow of water reaching the forests, and overfishing causing disruption to food chains and fish communities. Here are five of the many reasons we should be doing much more to preserve mangrove forests.They are a natural coastal defence, they are carbon sinks, they provide livelihoods, they encourage ecotourism, and they are rich in biodiversity.So we as *humans need to join our hands still more to conserve mangroves.*



Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title **Mangroves Ecosystem - Its Importance , Threats And FutureImplementations To Conserve It**

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Abstract Mangrove forests are extremely important in climate regulation, coastal protection, water purification and to provide essential habitat for numerous species and nesting fishes. Mangroves are reducing at an alarming rate, due to direct anthropogenic threats and global change including urban development, aquaculture, over extraction (for oil and gas production, for fuel wood) , conversion to aquaculture and agriculture and due to high rate of deforestation at a global loss rate of 1 to 8% per year. From 2000 to 2030, coastal resource exploitation and urbanization are expected to increase more than 35% reaching as much as 1.3 billion people. Several research studies also revealed that urban and peri-urban areas are estimated to expand by a further 1.2 million km^2 by 2030 to accommodate higher population density, and it is expected that a substantial proportion of this expansion will occur in the coastal regions. Climatic variability and its associated changes like temperature, rainfall, intense storms, wind fields, and high tidal fluctuations have extreme adverse impact on diversity, distribution, and productivity of mangroves now and in the near future. The recent high frequency of mangrove dieback and its mortality is mainly due to stressful conditions like extreme low sea-level event and extended droughts. Building networks of researchers, and strengthening links among researchers, local communities, practitioners, and policy makers is important to protect mangrove ecosystem. Mangroves and other blue carbon ecosystems have become the focus of various international initiatives, such as the International Blue Carbon Initiative and the International Partnership for Blue Carbon.

Poster

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title **Anthropogenic Threats To Mangroves**

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Abstract Mangrove ecosystem is one of the large ecosystem on the earth. Marine ecosystem play measure role in environmental cycle as well as in food and nutrition fulfilment, medicine, pollution control etc. But as all the ecosystems, this ecosystem also under threat, not only due to natural but also man made threats. To fulfill daily needs of growing population number of anthropogenic activities takes place in the mangrove ecosystem. Destruction of coral reefs and deforestation of mangroves takes place for coastal development, urban development, hotels, industrialization, agricultural land, salt land, aquaculture and fuel wood that loss their habitat. Which show direct impact on marine ecosystem. Due to the anthropogenic activity high amount of agricultural chemicals, industrial waste, plastic, garbage, oil etc. increases level of pollution. And extra nutrients cause eutrophication, which harms the adjoining coastal habitats by lowering the level of oxygen and changing in species distributions that is disturb the life cycle of marine habitat.

Key words: Anthropogenic threats**,** Mangrove ecosystem etc.

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Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title **Study of Oil Degrading Bacteria from Anjarle Creek, Tahsil- Dapoli, Ratnagiri**

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Abstract The entire globe is exposed to several types of pollution, and one of the tyep is oil pollution due to human carelessness. It is increasing in aquatic ecosystem such as mangroves and creeks because of growing consumption of petroleum products. Due to oil spill it directally affect on flora of mangroves.It affects the different system of flora and fauna of mangroves. This paper evaluate the effect of bacteria on oil seeps by bio-degradation method. The bio-degradable method is more effective and eco-friendly than chemical and mechanical method.

Keywords: Oil pollution, Biodegradation,Flora,Fauna,Mangroves.

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Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title **Mangroves Ecosystem**

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Abstract Mangroves ecosystem are found between land and sea on tropical and subtropical areas of the earth. These areas have humid climate, high salinity, extreme tides, strong winds, high temperatures and muddy, anaerobic soils. So they show various morphological and physiological adaptations to tolerate all these condition. It is world's productive ecosystem which is distributed circumtropically in 112 countries and territories. Global coverage has been variously estimated at 10 million hectares. Three groups of mangroves: major mangrove species, minor mangrove species and mangrove associates are recognised. In mangroves ecosystem the producers are Red mangroves, White mangroves, Black mangroves. They have morphological specialization like aerial roots and specialized mechanisms of gas exchange. Physiological specialization includes extraction of salts. Mangroves ecosystem includes consumer usually decomposers like worms, snails, mussels, oysters, shrimp, clams, crabs, small fishes, mullet, tube worms and bristle worms. Very few organisms directly feed on mangroves for ex. Coffee bean snail. Inaddition with this 70 other species of ants, spiders, mites, moths, roaches, termites, and scorpions are also found in mangroves ecosystem. Birds like spoonbills (Ajala ajala), large snowy egrets (Cosmorodium albus), scarlet ibis (Eudocimus ruber), fish hawks (Pandion haliaetus), royal terns (Sterna hirundo), West Indian whistling-ducks (Dendrocygna arborea), and Storm's Storks. Mammals like dolphins (Platenista gangetica), mangrove monkeys (Macaca mulatta) and otters (Lutra perspicillata) i flying fox etc are found in mangroves ecosystem.. It provides number of goods and services to the human beings and marine animals.

Keywords: Mangrove, ecosystem, climate, producers, consumers

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Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title **Mangroves: The Boon of Nature**

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Abstract Mangroves are intermediate landform lying in between land and sea. Those are halophytic plants which can tolerate saline water logged condition. Because of their high salt tolerance, Mangroves are among the first life forms which colonize mud and sandbanks grow along with coasts and estuaries. Regarding the mangrove cover of India, The state -West Bengal (Sunderbans) occupies highest percentage i.e. 2114 km^2 This is followed by Gujrat (Gulf of Kutchh, Gulf of Khambhat, Dumas-Ubhrat), Andaman & Nicobar (North Andaman- Nicobar) and Maharashtra by occupying 1140 km^2, 617 km^2 and 617 km^2respectively. The Karnataka (10 km^2) and Keral (9 km^2) shows very less mangrove cover. Mangroves provide foundation for growth and development of other organisms. They provide habitat for variety of terrestrial as well as coastal communities and protect them from wind, waves and floods. Mangrove forests are carbon-rich ecosystem on the earth. Mangrove forests are important source of sea food and it is beneficial for coastal community. Likewise it provides fire wood and timber. The Mangrove forest has an important role in climate regulation, water filtration etc. Mangroves has great medicinal property. Mangroves are effective on oral and cervical cancer and HIV. It has anti-diabetic properties. Thus, the importance of mangroves suggests that, Save mangroves for better future of our planet.

Poster

Climate Change, Mangrove & Sustainable Management

ISBN: 978-93-88901-10-9

Title **Threats to Mangroves and Climate Change**

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Abstract Mangrove ecosystems are threatened by climate change. Mangroves are amongst the most productive marine ecosystems on Earth, providing a unique habitat opportunity for many species and key goods and services for human beings. They offer protection from catastrophic events, such as tsunami, tropical cyclones and tidal bores and can dampen shoreline erosion. Despite their importance, mangroves are disappearing at a global loss rate of 1-2% per year, and the loss rate reached 35% during the last 20 years. Mangrove habitats are regressing at an alarming rate, due to direct anthropogenic impacts and global change. Climate change is likely to have a substantial impact on mangrove ecosystems, through processes including sea level rise, changing ocean currents, increased storminess, increased temperature, changes in precipitation and increased CO_2. These factors are inter-related and spatially variable on inter-regional scales (climate, geomorphology, biodiversity, forest structure, tidal range, climate change impacts) and human activities (urban development, aquaculture, mining, and overexploitation of timber, fish, crustaceans and shellfish) represent major threats for mangrove habitats. Pollution and over-exploitation are also reducing the ecosystem services provided by mangroves. Changes in local water conditions caused by upstream dams, irrigation and pollution have led to the loss of many mangroves. Rising sea levels are a longer-term challenge.

Keywords : Climate Change, Ecological Impacts, Mangroves

Poster

Climate Change, Mangrove & Sustainable Management
ISBN: 978-93-88901-10-9

Title Importance of Mangroves

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Abstract Mangrove ecosystem is the most important and divers aquatic ecosystem in the world. All plant parts of the mangrove are beneficial for mankind's. Mostly mangrove wood have used to various purposes such as manufacture of furniture, boat and fishing gear and also used for fire wood and charcoal production. Most important use of mangrove is to provide food for many coastal communities. Mangrove protect our shoreline from various destructive activities such as storm hurricanes winds, waves and floods. Mangrove ecosystem provide a crucial role in nourishment of small fishes, Mollusk, small crustaceans and also provide shelter for crabs, crocodiles, variety of fishes. Mangrove gives amusement to hunter and fisherman. Mangrove also provide good job opportunities for unemployed in the field of travel and tourism.

Climate Change, Mangrove & Sustainable Management
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Title

Ecological Benefits of Mangrove

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Abstract

Mangrove forests are one of the most productive and biologically significant habitats, as they provide human society with products and services. "Mangrove" is a mixture of the Portuguese word "Mangue" and the English word "grove."Mangroves are salt-tolerant plants in tropical and intertidal subtropical regions of the world. The unique areas in which these plants occur are called the 'mangrove ecosystem'. Mangrove habitat distribution on Indian coastline suggests that Sundarban mangroves occupy a very wide area followed by Andaman-Nicobar Islands and Kutch Gulf in Gujarat. The rest of the mangrove habitats are much lower. A fair number of experiments have been conducted in virtually all habitats, however from these areas over 1600 plant species and 3700 animal species were reported. The mangrove forests help protect shorelines and reduce the destructive effects of natural disasters including tsunamis and hurricanes. They also act as breeding and nursing grounds for commercially valuable marine finfish and shellfish species. Mangroves, including associated soils, could sequester about 22.8 million tons of carbon per annum. The woods occupy just 0.1 percent of the continental surface of the earth and account for 11 percent of the overall terrestrial carbon intake into the ocean and 10 percent of the terrestrial dissolved organic carbon (DOC) exported to the ocean.

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Title **Sustainable Mangrove Ecosystem- UNESCO Initiative**

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Abstract

Mangrove ecosystem have great ecological value providing the various goods and services to the different communities. The mangrove forest ecosystem nourishes the different biological organisms and protect the different species likely to be threatened in the particular habitat. The such ecosystem is important for the economic security and food sovereignty of the local communities. The mangrove ecosystem inspite of its great ecological and economical significance under the threat of the Coastal developments, overharvesting, pollution, oil extraction, oil spills, etc. To promote the conservation of the most valuable mangrove ecosystem and sustainable use of this ecosystem for offering goods and services and to point out the cultural, Social, spiritual aspects of the mangroves form the ecosystem various initiatives have been started for the conservation and protection of the ecosystem. The United Nations Educational, Scientific and Cultural organisation specialised agency of the United Nations with 193 members of the states and 11 associate members aimed for contributing for building peace, eradication of poverty, sustainable development, intercultural dialogues through education, Communication and information. The UNESCO engaged in conservation of mangrove ecosystem for sustainable development, incorporation of the ecologically significant biodiversity rich mangrove forest ecosystem under Biosphere reserves, World Heritage sites and Global Geoparks helps for the protection and management of the ecosystem with the local , National and International efforts.

UNESCOs Blue Carbon Initiative is an initiative works on development of management approaches, financial incentives, and policy mechanisms for the conservation, restoration and sustainable use of coastal blue carbon ecosystems, it supports the local , national and international governmental agencies to promote the policies for the conservation and assessing of coastal blue carbon stock. It works to protect and restore coastal ecosystem and reduce impact of the climate change. It also provides guidance for research, project implementation and policy priorities. The blue carbon initiative research carbon sequestration, storage and loss of carbon from blue carbon stock system. The UNESCO designated sites includes the mangroves in Biosphere Reserves, World Heritage site and Geoparks helps for the management and protections of the ecosystem.

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Title

Mangroves: A ray of hope. Mangroves are not waste, they are best.

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Abstract

A mangroveis a shrub or small tree that grows in coastal saline or brackish water and also occur in the coastal intertidal zones of tropics and the sub-tropics. Mangroves are salt-tolerant trees, also calledhalophytes, and are adapted to life in harsh coastal conditions. They contain a complex salt filtration system and complex root system to cope with salt water immersion and wave action. Mangroves are tropical species generally found on sheltered coastlines and estuaries. Till about 1960s, mangroves were largely viewed as “economically unproductive areas” and were therefore destroyed for reclaiming land for various economic activities. Gradually, however, the economic and ecological advantages of mangroves have become visible and their importance is appreciated. Every ecosystem supports human life by giving direct or indirect benefits and services. Mangrove areas are one among the most productive ecosystems on this planet.In terms of economic value, mangroves provide huge benefits. The total economic values for mangrove habitats hence range from US$ 2,772 ha yr up to as much as US$ 80,334 ha yr (average US$ 28,662 ha yr).Mangrove forests have often been seen as unproductive and smelly, and so cleared to make room for agricultural land, human settlements and infrastructure (such as harbours), and industrial areas.More than 35% of the world’s mangroves are already gone.Recognizing the need and importance of mangroves, a Public Interest Litigation was filed by Mr. Debi Goenka in the Bombay High Court, seeking the Court’s intervention to inhibit the destruction of Mangroves. Through the efforts of CAT, about 14500 hectares of mangroves have been notified as forest areas in the state of Maharashtra.

Key words: Mangrove, Halophytes, Ecosystems.

Our Knowledge Partners

Mangrove Society of India, Goa, India

The Mangrove Society of India (MSI) in a non-profit and non-political Organization (NGO) that has been working for conservation, management, sustainable use and to create awareness of Mangrove in India. MSI was established in 1990 by Oceanographers, Marine Biologists and foresters and registered under the society act Government of India with registration No. 90/Goa/1990. MSI has more than 150 active members spread across the coastal states of India. Many of its members are consultants, Advisors to various Govt. and Non-Govt. agencies, private corporate houses and some are on the national and international Mangrove committees. MSI also has affiliation with NGO's, Govt agencies, research institutes, corporate houses and stakeholders as well as International Society for Mangrove Ecosystem (ISME), Okinawa, Japan.
The Vision of MSI is
"Protect mangroves, mangroves protect"

Founded in 2020, 'Sahyadri Botanical Society' is a duly registered society whose mission is to promote botany as fundamental science useful for mankind. The objectives of the Society are to: endorse the cause of Botany and uphold the interests of Botanists in Maharashtra, sustain and provide improved formal and informal education about plants, create the interest about the botany among the students by organizing various competitions, arrange periodical excursions to different parts of Maharashtra for the study of its vegetation, tree plantation, encourage basic plant research, organize workshops, seminars and conferences related with the Botany for students and faculty, perform all other activities for the fulfillment of the objectives of the Society. The society is run actively under the leadership of Principal, Dr. D. D. Kurlapkar (President), Principal Dr. C. J. Khilare (Vice President) and Professor D. K. Gaikwad (Secretary). All the teachers of Botany are strongly encouraged to join the Sahyadri Botanical Society.

Sahyadri Botanical Society, Kolhapur, India

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