

Gujarat Institute of Desert Ecology

Annual Report 2019-20



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GENESIS

Gujarat Ecology Commission set up by the Government of Gujarat signed a Memorandum of Understanding, in the gracious presence of the Hon. Chief Minister of Gujarat, with The Jacob Blaustein Institute for Desert Research, Israel, on 9th September 1993, for (i) rehabilitation of degraded soils to increase production of biomass, (ii) to assist in preparing plan for restoration of degraded eco-systems, and (iii) to assist in planning of a Centre of Desert Ecology in Kachchh. Subsequently, Prof. Uriel Safriel, Director of Mitrani Centre of Desert Ecology, Israel visited Kachchh in May 1994. Based on his recommendations, Forests and Environment Department of the Government of Gujarat vide Resolution dated 10th January 1995 accorded administrative sanction to establish

Institute of Desert Ecology. Thus, Gujarat Institute of Desert Ecology was established at Bhuj, Kachchh district as an autonomous body and was registered as a Society and a Public Trust.

MISSION

GUIDE will catalyse the process of ameliorating hardships to human beings in desert ecosystems of Gujarat, following sound ecological principles and carefully using scientific knowledge, imaginative technology and capital.

MANDATE

- Focus on desert and arid ecosystems of Gujarat, with special emphasis on Kachchh,
- Develop a benchmark database for ecosystems of Kachchh and thereafter undertake continuous monitoring and trend-analysis through specific research activities,
- Identify problem areas and evolve appropriate solutions and management strategies, with the help of applied research,
- Formulate and implement relevant projects that would provide models for emulation,
- Disseminate ecological information and communicate action plans to suit local conditions, through extension and other programs, and
- Provide consultancy and training to NGOs, Government officials, corporate sectors and other natural resource managers, in the principles of ecology, integrated management and sustainable development.



DIRECTOR'S NOTE

Gujarat Institute of Desert Ecology (GUIDE), stepping into its 25th year (Silver Jubilee Year), continues to function as a pioneering research institute striving to address the needs of community through its research agenda. In order to fulfill its avowed mandate to achieve a synergy of science and community in the field of ecology and environment, GUIDE has made added progress.



Akin to previous years, GUIDE's infrastructure has been improved both qualitatively and quantitatively which now includes a full-fledged complex spread over 4 acres of land, a modern administrative building, hostel, a well equipped NABL Accredited laboratory with state of the art equipments, compatible working environment aided by over three dozen computers, sophisticated software and library with access to many books and online international journals. Greening the campus has been continued further with the plantation of more than 400 saplings during this year.

In order to strengthen its scientific manpower and to enhance its reach, GUIDE has recruited a team of highly qualified and experienced

scientists (Dr. K. R. Saravanan as Senior Scientist, Dr. G. Jayanthi as Scientist and Dr. L. Prabhadevi as Advisor) and researchers (Dr. Nakul. A. Bhatt, Mr. Paras Pal, Ms. Dhara Mehta and Ms. Asha Sharma) with multi-disciplinary background who will work on different aspects of diverse ecosystems, biodiversity and livelihood opportunities in Kachchh and other ecosystems of Gujarat. The stewardship and unflinching effort rendered by our Chairman Shri S. G. Mankad, IAS (*Retd.*) and the Board of Governors of GUIDE are enabling us to function with vigour and quality over the previous years.

In yet another attempt to acquire global reach and to grab world attention for the Kachchh dryland issues, GUIDE has played a pivotal role in much collaboration. Dr. V. Vijay Kumar has visited Germany for explorations of potential association in an ongoing project on "Literary Modelling and Energy Transition" funded by the Volkswagen Foundation, Germany and he has visited Muenster University and Karlsruhe Institute for Technology in Germany between 10th and 13th September 2019.

Besides, to enhance the rigor in scientific research, an effort has been initiated to have research collaborations with many national and international institutes / Universities. First initiatives were taken with universities in Germany. Collaborations would be in the form of joint conferences and area-based research studies. In similar instant, the Professors from Muenster University will be visiting GUIDE during November 2020 for discussions and finalization of research programmes and joint conferences and modalities for further collaborations.

GUIDE has organised several programmes to address conservation of environment and biodiversity. "Save Frog Day" event was celebrated on 1st May 2019 in which senior officials from Arid Communities and

Technologies (ACT), Bhuj-Kachchh attended the function. “International Biological Diversity Day” was celebrated on 22nd May 2019, in which Dr. V. Vijay Kumar and Dr. A. K. R. Mahato delivered talks on “Gandhiji and Environment” and “Biodiversity Crisis” respectively. “World Environment Day” was celebrated on 5th June 2019, in which plantation activities were undertaken in GUIDE campus. Also, Dr. V. Vijay Kumar and Dr. K. Karthikeyan attended the Environmental day celebration at Jindal Saw Limited, Mundra. Further, GUIDE has organized an “International Coastal Clean-up Day on 21st September 2019” at Mandvi beach, Kachchh in collaboration with NCCR, MoES, Gol, Chennai. The event NCCR was attended by students from schools and college of Mandvi, representatives from Mandvi Nagarpalika and officials from Border wing and BSF departments.



GUIDE has also taken part in the Campus Bird Count 2020 as a part of Great Backyard Bird Count – India organized on 14th to 17th February 2020.

In the areas of research guidance, GUIDE’s scientists are guiding 9 PhD scholars, in which 2 scholars have submitted their thesis for the award of the doctorate degree. Further, GUIDE scientists have guided dissertation studies of 14 Post Graduate students and 2 Under Graduate students. Apart from these, 17 Post Graduate students and 5 Under Graduate students from various Universities of the country undergone internship and trainings at GUIDE.

GUIDE scientists and researchers have attended many national and international seminars and symposiums and presented several research papers. Ms. Monika Sharma, Ph.D Research scholar has bagged the Best Paper Award in the Microbiology subject category in the National Seminar on “Emerging trends in Science and technology: Challenges and Opportunities” held on 8 February 2020, organized by Tolani College of Arts and Science, Adipur, Kachchh.

Scientists and researchers were encouraged to undertake training programmes as part of capacity building. Dr. K. Karthikeyan has attended Four days Training program on “Laboratory Management System as per ISO/IEC 17025:2017 requirements & Internal Audit” organized by ICMR-NIOH, Ahmedabad & Centre for Food & Water Technology, Mumbai during 12-15 December 2019.

Dr. V. Vijay Kumar has delivered a talk on “Climate Change & Eco-System based Adaptation” as part of “Eco-System Conservation for Disaster Risk Reduction” on 29th May 2019 at GIDM, Gandhinagar. In the aforesaid event Dr. R. Chandra has also delivered a talk on ‘REIA and Integrating Eco-DRR in Disaster Recovery and Reconstruction in Gujarat’ on 28th May 2019 at GIDM, Gandhinagar.





Dr. Arun Kumar Roy Mahato delivered a lecture in the Seminar on “Air Pollution” organized on the occasion of World Environment Day 2019 by the Department of Environmental Science, M S University of Baroda, Vadodara on 5th June 2019. Dr. K. Karthikeyan has attended the meeting of MoEF&CC on “World Day to Combat Desertification” on 17th June 2019 at New Delhi on behalf of Director, GUIDE. During the meeting, Honourable Minister of MoEF&CC released the Logo of COP-14 and launches the Pilot Project on Forest Landscape Restoration (FLR) and Bonn challenge in India by NAEB, MoEF&CC in consultation with IUCN. Dr. Nikunj Gajera on behalf of Director, GUIDE participated in the COP 13 Conference, Gandhinagar between 15th and 18th February 2020. Dr. K. R. Saravanan and Dr. G. Thirumaran attended the Second Brackish water Aquafarmers (BAFAC-2020) at Surat on 19th and 20th February 2020, organized by CIBA, Gol, Chennai. Mr. Dayesh Parmar participated in the NRSC User Meet – 2020 at Hyderabad on 26th and 27th February 2020. Further, Dr. Arun Kumar on behalf of Director, GUIDE attended the International Conference on Eco-health and Environmental Sustainability (ICEES), Vadodara on 26th February 2020.

Dr. V. Vijay Kumar attended 7th Asian Regional Conservation Conference at Islamabad during the period between 6th and 8th November 2019, organized by the IUCN. The Indian delegates had a separate meeting with the President, IUCN along with the Director General – IUCN, Regional Director, IUCN-Asia and Dr. T. P. Singh. Other prominent events of this year in GUIDE’s calendar were; organization of National Conference on ‘Plastics in the Environment-Current Status and Rethinking the Future of Plastics’ on 7th March 2020 at KSKV Kachchh University, Bhuj-Kachchh, as part of the Silver Jubilee celebration of GUIDE.

The Keynote was addressed by Dr. K. Kadirvelu, Coordinator & Joint Director of DRDO-BU Center for Life Sciences, Bharathiar University, Coimbatore, Tamil Nadu. Followed by three technical presentations, 10 research presentations and 35 poster presentations. The conference was attended by 135 participants from various Universities and Institutes.

There have been certain other achievements too and among them significantly are publication initiatives of a booklet on “Multi-species Mangrove Biodiversity Park in Kachchh, Gujarat” which was jointly published by GUIDE and Adani Foundation, Mundra. The Booklet was released by the Hon. Vice Chancellor of the KSKV Kachchh University, Bhuj-Kachchh on 7th March 2020 at the National Conference on “Plastics in the Environment-Current Status and Rethinking the Future of Plastics”. Among scientific publications, eleven research articles were published in national and international journals.

As part of the Journal Club of GUIDE, an interactive platform to share the research experiences and discussion, in which presentations were

made by Scientists/Researchers of GUIDE along with students, researchers and experts from various Universities and Institutions. Further, as a part of the curriculum, the higher secondary science students (20 students) of Chanakya Academy, Bhuj had visited the various units of the Environmental Laboratory Division of GUIDE on 7th December 2019. The students were narrated about various activities of the Institutes including research project activities of Terrestrial ecology, Coastal and Marine Ecology, Environmental impact assessment and herbarium section. Five Faculty Members and 32 Students from Department of Botany, C. C. S. University, Meerut – UP visited GUIDE on 29th February 2020 in which Dr. V. Vijay Kumar delivered a talk about GUIDE and its Research Activities.

Added, 4 Faculty Members and 30 Students from TERI University, New Delhi visited GUIDE on 2nd March 2020. Dr. V. Vijay Kumar and Dr. Arun Kumar Roy Mahato delivered talks about GUIDE and its Research Activities and Kachchh Biodiversity respectively. The team

had visited again on 5th March 2020 for interactive sessions conducted at GUIDE, in which biodiversity and grassland experts from GUIDE, KSKV Kachchh University and the Chief Conservator of Forest – Kachchh Circle and other officials from the Forest Department have taken active part in the discussions.



THRUST AREA

Research and Studies

- Desertification and land degradation process
 - Biodiversity assessment and its conservation and management
 - Restoration of degraded ecosystems including grassland, forests, wetlands, mangroves, etc.
 - Ecological restoration of mining and industrial areas
 - Regional environmental assessment and planning
 - Socio-economic studies for development options
- Natural resource management in arid and semi-arid zones (rangeland ecology, agro-ecology)
 - Impact of invasion by exotic and introduced species
 - Remote sensing & GIS applications for biodiversity conservation and environmental planning
 - Coastal biodiversity and coastal monitoring
 - Seaweed and Polyculture activity
 - Development and conservation options for Rann of Kachchh
 - Watershed development and management



SERVICES OFFERED BY GUIDE

Research

- Terrestrial Biodiversity assessment and conservation studies (Biodiversity Action Plan-BAP)
- Climate vulnerability studies
- Restoration of degraded lands (Grassland and saline kinds)
- Remote sensing & GIS applications for biodiversity conservation & environmental planning
- Social Impact Assessment (SIA) and Social Impact Management Plan (SIMP) and Social Audit (SA)
- Feasibility studies for Community Development projects
- Monitoring and Evaluation:
 - Third party evaluation for CSR projects
 - Geo-tagged, mobile app-based surveys
 - Data analysis and visualisation
- Marine Ecological Impact Assessment studies of port and coastal industries
- Ecological health assessment (Benthic faunal diversity)
- Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP)
- Environmental monitoring of matrices such as Air, Stack, Water, Soil, Sediment & Industrial effluents, etc.
- Environmental Auditing
- NABL Accredited Laboratory services as per ISO / IEC 17025: 2005

Capacity Building and Knowledge Management

- Provide training, develop knowledge products, education and communication (IEC) materials in the areas of sanitation, hygiene, health, water conservation and safe usage, environmental awareness, biodiversity conservation, and natural resource management, seaweed and polyculture, laboratory analytics, mushroom cultivation
- Capacity Building of NGOs in real time data collection and motivate to take data driven decisions

Community Outreach and Implementation

Activities

- Mangrove Restoration and plantation activities
- Implementing Government / CSR funded Watershed development, carbon neutral livelihood projects and environmental conservation initiatives.
- Build community-based climate resilience technologies and cool roofs.
- Promote social / village forestry in the rural and urban areas to increase biodiversity and to reduce heat stress.

Teaching and Research Guidance

- GUIDE scientists are actively involved in guiding Ph.D. and Master's degree students from various universities across the country. They are also guiding Bachelors students in Marine Sciences from the Government Science College, Mandvi, and Government Engineering college, Bhuj, Gujarat and various other universities and colleges within and outside the state.



INFRASTRUCTURE

Campus

With a substantial green cover, GUIDE campus is spread over an area of 04 acres. The campus encompasses earthquake resistant main institute building with administrative block, Environmental laboratory, RS and GIS Cell, Environmental Audit Cell, library and board room. Earthquake resistant hostel block with 08 double occupancy is located adjacent to the institute, which provides well-furnished accommodation and dining facilities for researchers.



There are also 12 quarters for scientists, and a director's bungalow next to the main building. A green house and chamber for the cultivation of mushrooms are situated within the premises for

experimental and training purposes. The campus is rich in biodiversity with more than 250 species of plants and 72 bird species. Many birds breed within the campus with more than 100 nests of house sparrows. The Scientists of GUIDE have identified and cultivating rare medicinal plants within the campus. About 123 medicinal plants have been identified including *Commiphora stocksiana*, *C. wightii*, *Grewia tenax*, *Cassia fistula*, *Azadirachta indica*, *Tinospora cordifolia*, *Tecoma undulata*, *Capparis cartilaginea*, *Adansonia digitata*, *Acacia nilotica*, *Prosopis cineraria*, *Vitex negundo*, *Cassia auriculate* etc. GUIDE is also propagating endangered and uncommon plants of Kachchh at the campus to establish a seed bank for subsequent plantations.

Analytical Laboratory

The environmental laboratory of GUIDE is accredited by National Accreditation Board for testing and calibration Laboratories (NABL), Quality Council of India in the field of chemical testing (water & waste water) as per ISO/IEC 17025:2005. The laboratory is equipped with state-of-art facilities instruments/equipment viz., Atomic Absorption Spectrophotometer, UV-Vis Spectrophotometer, Flame photometer, Respirable Dust Samplers, Spectro fluorophotometer and Ion Chromatography etc., to facilitate analysis of air, water, wastewater, soil, sediment for physical, chemical, microbial and biological parameters. The laboratory facilities at GUIDE undertake regular analysis of environmental samples related to its in-house research activities, industrial sectors, agriculturists and NGOs. The laboratory consists of internal units



like water and soil, microbiology, marine, chemical, instrumentation and Environmental Engineering, Monitoring and Audit.



Herbarium and Museum

The herbarium has great significance and is essential for the study of plant taxonomy, geographic distributions, and the stabilizing of nomenclature. Well established herbarium facility with vast collection of angiosperms of Gujarat State is available as a reference centre for students and researchers. A total of 1011 floral species and around 5600 herbarium sheets are preserved at GUIDE. Specimens of intertidal molluscan shells from Kachchh and Jamnagar coastal habitats are preserved as ready reference materials. Efforts are also being made to set up a museum of marine fauna of Gulf of Kachchh.



Library and Documentation

GUIDE's library houses 1406 books on different aspects of the environment including ecology and climate change. A separate documentation unit with around 597 technical and research reports has also been maintained.



PROJECT HIGHLIGHTS

DIVISION OF TERRESTRIAL ECOLOGY – COMPLETED PROJECTS

1. LONG TERM BIRD BASELINE ASSESSMENT FOR 250-300MW WIND FARM SITE NEAR BARANDA, NAKHATRANA – KACHCHH DISTRICT, GUJARAT.

Funding Agency : ERM India Private Limited, Gurgaon

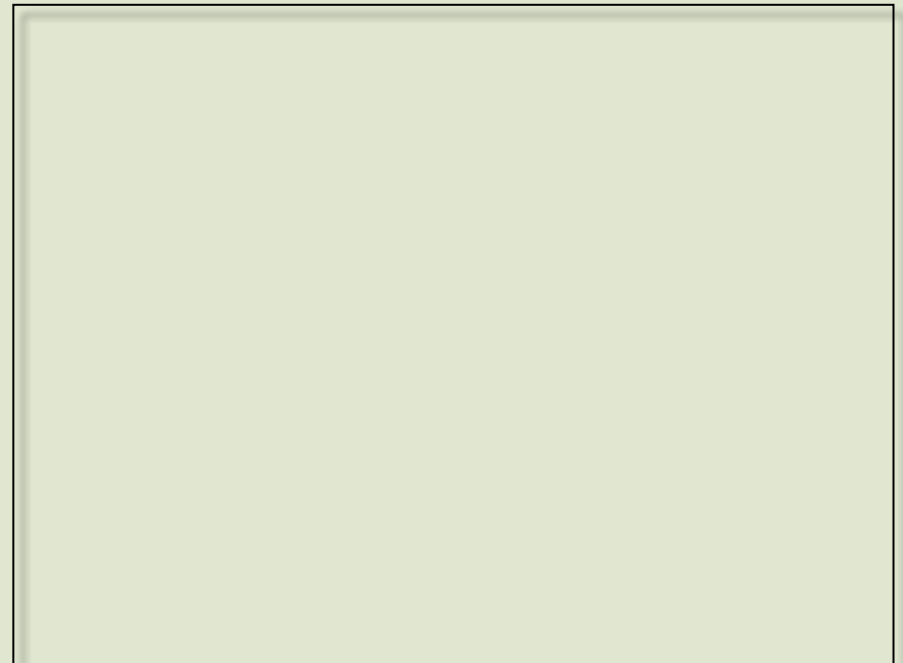
Project Team : Arun Kumar Roy Mahato, Nikunj B. Gajera, Mukesh H. Koladiya, Viral D. Vadodariya

Project Duration : October 2018 - July 2019

Environmental Resource Management (ERM), Gurugram is an environmental consultant for the proposed Wind Power Plants in Baranda, Kachchh promoted by Enel Green Power. The project site is situated along the southern boundary of the Narayan Sarovar Wildlife Sanctuary in the western part of the Kachchh District. The ERM assigned the task of bird survey and its assessment to GUIDE. The objective of the bird baseline assessment is to develop a comprehensive baseline for understanding avifaunal diversity, to identify conservation related target species such as IUCN Red-List CR and EN and restricted range species or any species whose migration / congregation numbers in the project area.

The bird assessment was conducted on the basis of intensive surveys, including line transect survey, vantage point survey, observation of the sky, speed walking, and drive through. The survey recorded 132 bird species in which 36 species were migratory, 80 species were resident and rest of 16 species were

resident migratory. Of the species recorded, 123 were of the least concern category, 6 were near threatened species, 2 were vulnerable and one was in the endangered IUCN Redlist category. Among the species reported, 9 were classified under the Schedule - I of IWPA, 1972.



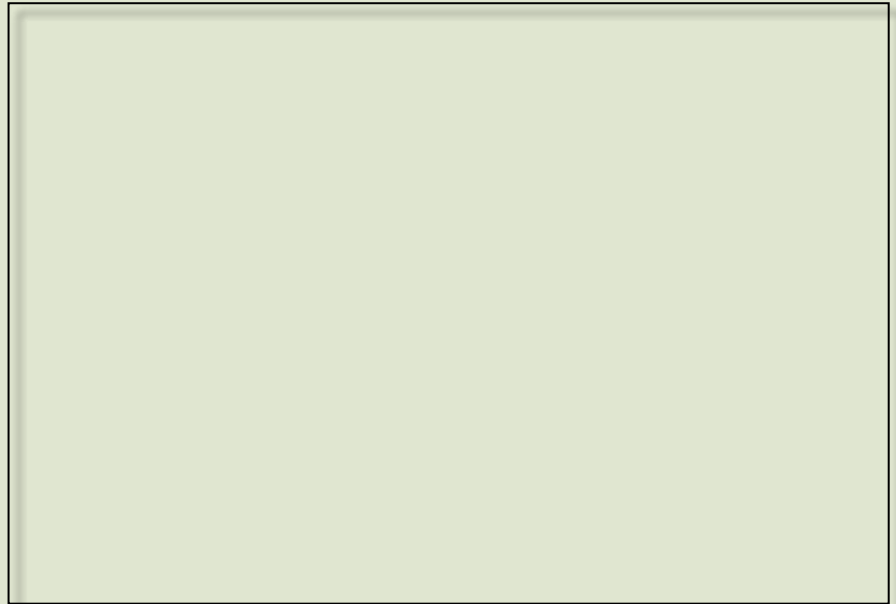
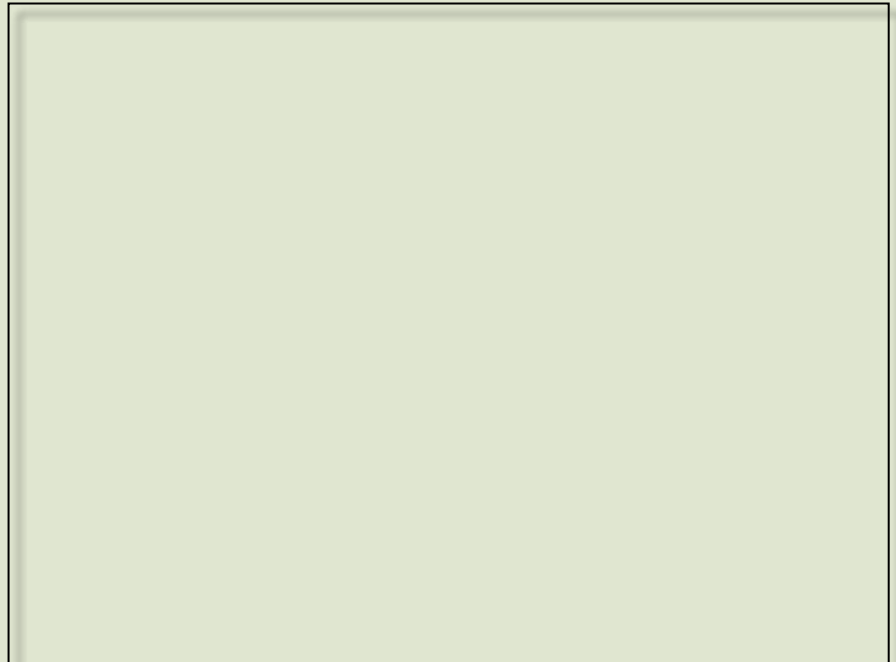
2. LONG TERM BIRD BASELINE ASSESSMENT FOR 250-300MW WIND FARM SITE NEAR JAMKAMBHALIYA, DEVBHUMI DWARIKA DISTRICT, GUJARAT.

Funding Agency : ERM India Private Limited, Gurgaon

Project Team : Arun Kumar Roy Mahato, Nikunj B. Gajera ,
Viral D. Vodadariya and Mukesh H. Koladiya

Project Duration : April 2017 to June 2019

Environmental Resource Management (ERM) Gurugram is an environmental consultant to Enel Green Power 's planned Wind Power Plants in Jamkhambhaliya, DevBhumi Dwaraka District, Gujarat. The purpose of the bird baseline assessment is to establish a baseline for understanding avifaunal diversity, to recognise conservation-related target species such as IUCN Red List CR and EN and restricted range species or any species whose migration / congregation numbers are within the project region. The project site is located along the northwestern part of the Jamkambhaliya Taluka, Devbhumi Dwaraka district. The survey found 139 bird species in which 38 species were migratory, Among the recorded species, 128 species fall under least concern category; 8 species were near threatened, Of the bird species, 128 were of the least concern category; 8 were near threatened, 2 were vulnerable and one was in the endangered IUCN Redlist category. Of the species recorded, 9 were listed in Schedule - I of IWPA, 1972.



3. ECOLOGICAL STUDIES ON BIRDS OF PREY IN LITTLE RANN OF KACHCHH: PARADIGM SHIFT IN SPECIES ASSEMBLAGE IN SALT MARSH ECOSYSTEM.

Funding Agency : Gujarat Forest Research Institute, Gandhinagar

Project Team : Arun Kumar Roy Mahato, Nikunj B. Gajera ,
Viral D. Vodadariya and Mukesh H. Koladiya

Project Duration : April 2017 to June 2019

Birds of prey, species of birds that hunt and feed live organisms are also known as Raptors, which play a significant structural and functional role in its ecosystems. Rann is one of the strategic locations on the Central Asian Flyway and offers appropriate habitats for feeding, breeding and roosting a large number of birds, including birds of prey. Over the years, the availability of suitable habitats for raptors in the Rann landscape has declined. Anthropogenic activities associated with climatic uncertainties in the landscape have posed several challenges to the survival of raptors. The study recorded a total of 22 species of raptors from the study area, Among the species of raptors reported in the LRK, nine species were resident birds, while the remaining 13 species were migratory.

During the road-side transect survey, total 22 species of raptors with an individual of 272 were recorded, with a density of 2.30 individuals/km². While, 17 species and 186 individuals with a density of 0.25 individuals/km² of raptors estimated by line

transect survey from the LRK landscape. The Shannon-wiener diversity of raptors was recorded during the study period by vehicle transect and line transect was 2.72 (H') and 2.36 respectively. The study found that about 55 per cent of the geographical areas of the LRK landscape are highly suitable for raptors, followed by 15 per cent of the area being moderately suitable, 22 per cent less suitable, while about 8 per cent of the area is unsuitable for raptors.



4. PREPARATION OF MICRO PLAN FOR 28 GUGGAL PLANTATION FOREST VILLAGES OF KACHCHH WEST FOREST DIVISION OF KACHCHH DISTRICT, GUJARAT.

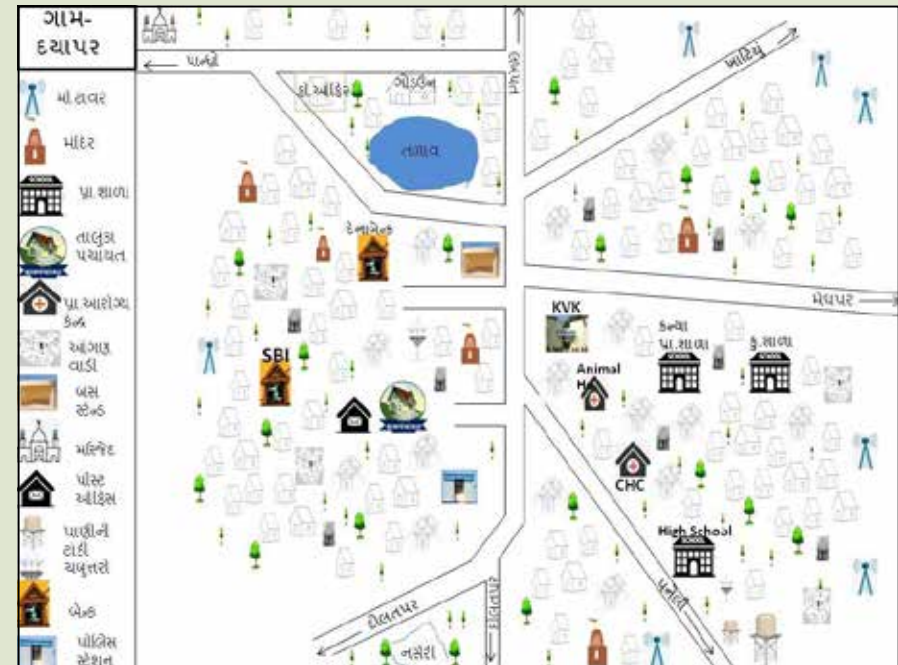
Funding Agency : Kachchh West Division, Bhuj

Project Team : Mukesh H. Koladiya, Ajay K. Gohel, Arun Kumar Roy Mahato and Viral D. Vadodariya

Project Duration : March 2019 to June 2019

To conserve and ensure the sustainable utilization of *Commiphora wightii*, a medicinal plant commonly known as Guggal in 28 villages falls under West Forest Division of Kachchh, thus the department has approached GUIDE to prepare a Micro-Plan in accordance with the MoEF & CC guidelines.

The GUIDE team studied the available natural resources and infrastructure, livestock and available livelihood opportunities for the local communities. The study found unemployment, lack of irrigation facilities, minimum agricultural productivity due to high salinity and poor soil fertility, high dependence on ground water for irrigation, invasiveness of gauchar land as primary issues. Based on the results, the study suggested steps such as improving irrigation facilities, developing gauchar land, raising awareness of sustainable use of natural resources, improving transport and communication facilities, and raising awareness of the available government schemes.



5. PREPARATION OF MICRO PLAN FOR 16 GUGGAL PLANTATION FOREST VILLAGES OF KACHCHH EAST FOREST DIVISION OF KACHCHH DISTRICT, GUJARAT.

Funding Agency : Kachchh West Division, Bhuj

Project Team : Mukesh H. Koladiya, Ajay K. Gohel, Arun Kumar Roy Mahato and Viral D. Vadodariya

Project Duration : March 2019 to June 2019

The East Forest Division of Kachchh has approached GUIDE to prepare the Micro Plan in compliance with the MoEF & CC guidelines in order to protect and ensure sustainable use of *Commiphora wightii*, a medicinal plant commonly known as Guggal in 16 villages of east forest division of Kachchh. This plant has been used in Ayurvedic medicine for centuries and Ayurvedic texts dating back to 600 BC recommends it for treating atherosclerosis. Today guggul gum resin is used for arthritis, lowering high cholesterol, “hardening of the arteries” (atherosclerosis), acne and other skin diseases and weight loss.

The GUIDE team has explored the natural resources and opportunities available to local communities for infrastructure, livestock and livelihoods. The study has documented social and eco-problems of the area of study. The study suggested taking measures to increase the irrigation facilities and the gauchar land by recognizing the scenario. Further, promoting fair and sustainable use of natural resources and improving public transport are also essential for the local development.



6. ASSESSMENT OF THE CHANGE IN AGRICULTURAL PRODUCTIVITY, LAND USE & LAND COVER, ENVIRONMENTAL ENTITIES IN VIEW OF ANTHROPOLOGICAL DEVELOPMENT IN BUFFER AREAS OF M/S. SHREE DIGVIJAY CEMENT COMPANY LIMITED, CHORBEDI-2 LIMESTONE MINE, VILLAGE - CHORBEDI, TALUKA - JAMJODHPUR, DISTRICT - JAMNAGAR, GUJARAT.

Funding Agency : Shree Digvijay Cement Company Limited, Jamnagar, Gujarat

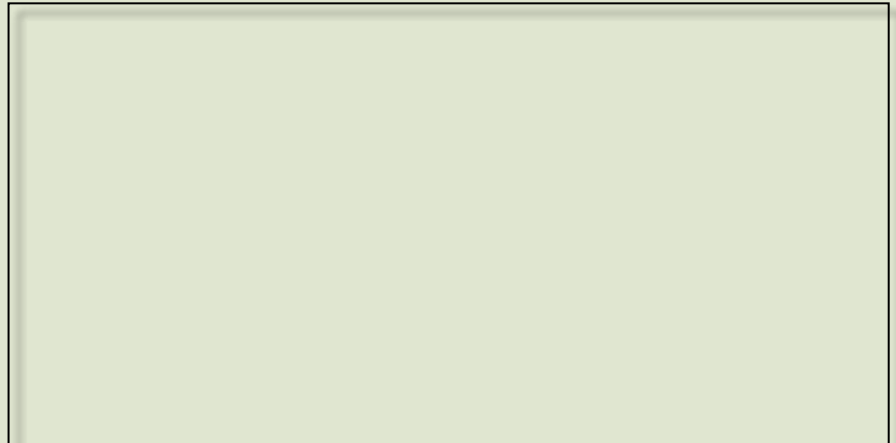
Project Team : Arun Kumar Roy Mahato, V. Selvakumar, Jayesh B. Bhatt, Dayesh M. Parmar, Ajay K. Gohel, Bhagirath R. Paradva, Viral D. Vadodariya

Project Duration : May 2019 to August 2019

Shree Digvijay Cement Company Limited (SDCCL) is one of the oldest operational cement plant of the country, assigned the task of assessing changes in agricultural productivity, land use and land cover, environmental entities in the light of anthropological developments in buffer areas of chorbedi-2 limestone mine, located in Chorbedi, Jamjodhpur Taluka, Jamnagar district, Gujarat. The study was conducted in the 10 km radius buffer zone of the mine lease area during May-August 2019.

A mixed method of research approach was adopted and multiple data collection tools, including household survey, focus group

discussion (FGD), personal interviews, resource-check list, document-content analysis were used to collect data from various stakeholders and documents, including villagers living nearby the mine. The study found that the buffer zone was undergoing development and the villages had access to electricity, primary schools, a considerable amount of pucca housing and sanitation facilities compared to 2003. In addition, the villagers have also received essential government identity cards, including Aadhar.



7. ASSESSMENT OF THE CHANGE IN AGRICULTURAL PRODUCTIVITY, LAND USE & LAND COVER, ENVIRONMENTAL ENTITIES IN VIEW OF ANTHROPOLOGICAL DEVELOPMENT IN BUFFER AREAS OF M/S. SHREE DIGVIJAY CEMENT COMPANY LIMITED, GOP-2 LIMESTONE MINE, VILLAGE - CHORBEDI, TALUKA - JAMJODHPUR, DISTRICT - JAMNAGAR, GUJARAT

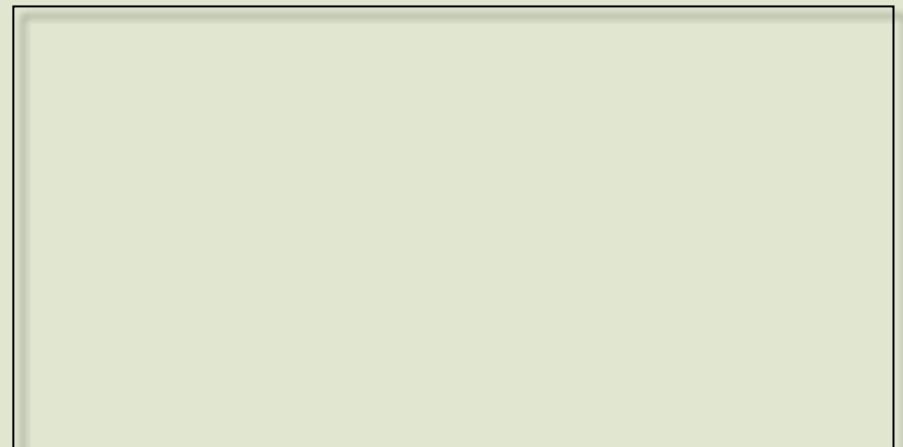
Funding Agency : Shree Digvijay Cement Company Limited, Jamnagar, Gujarat

Project Team : Arun Kumar Roy Mahato, V. Selvakumar, Jayesh B. Bhatt, Dayesh M. Parmar, Ajay K. Gohel, Bhagirath R Paradva, Viral D. Vadodariya

Project Duration : May 2019 to August 2019

Gop-2 Limestone Mines is a captive mine belonging to Shree Digvijay Cement Company Limited (SDCCL) located in Gop, a village within the jurisdiction of Jamjodhpur Taluka, Jamnagar District, Gujarat. SDCCL has approached GUIDE to conduct a study to estimate the socio-economic and environmental impact of the project and the overall human development in its mine's buffer zone. The human development was measured by the set of indicators including literacy level, socio- economic status, housing, water, sanitation, access to education, health facilities, electricity, government identity cards, public distribution system, public infrastructure facilities.

The study found that buffer zone is improving in the stated indicators as compared to 2003. The SDCCL also runs the school, technical training institution and vocational training for the women empowerment. Further, it was observed that soil, ambient air, surface and ground water quality parameters and noise level is under the prescribed limits of CPCB and other statutory guidelines of MoEF & CC, Govt. of India.



8. EX-SITU CONSERVATION OF THREATENED AND HIGHLY UTILIZED MEDICINAL PLANT (*Commiphora wightii*) IN SARKARI AYURVEDIC UDYAN, NANI RELADI, BHUJ, KACHCHH

Funding Agency : Gujarat Medicinal Plants Board, Gandhinagar

Project Team : Jayesh B. Bhatt, Arun Kumar Roy Mahato, Bhagirath R. Paradva, Rakesh A. Poptani

Project Duration : July 2016 - March 2020

The project aimed for the ex-situ conservation of threatened and extensively used medicinal Plant *Commiphora wightii* in Nani Reladi-Bhuj, Sarkari Ayurvedic Udyan, Kachchh. It grows as a shrub or small tree, reaching a maximum height of 4 m (13 ft), with thin papery bark. The extract of gum guggul, called gugulipid has been used in Unani and Ayurvedic medicine, for about 3,000 years in India. One chemical ingredient in the extract is the steroid guggulsterone that acts as an antagonist of the farnesoid X receptor. Under the project, 17 ha area of land was prepared by removing *Prosopis juliflora* and other weeds and Soil Moisture Conservation (SMC) by Contour bunding. Overall survival of *Commiphora wightii* from 2017 to 2019 was 65% which was an important milestone of the project. The project also made a significant contribution to the conservation of the rare plant species *Commiphora stocksiana*, which is on the verge of extinction as only four individual plants are known to survive in the wild in Kachchh, India. Total 6,000 saplings of *Commiphora stocksiana* species were raised, in which 2000 were planted in the Nani Reladi Medicinal Garden.



DIVISION OF TERRESTRIAL ECOLOGY – ONGOING PROJECTS

9. STATUS, SURVEY, DISTRIBUTION AND ECONOMIC EVALUATION OF MEDICINAL PLANTS OF KACHCHH DISTRICT, GUJARAT

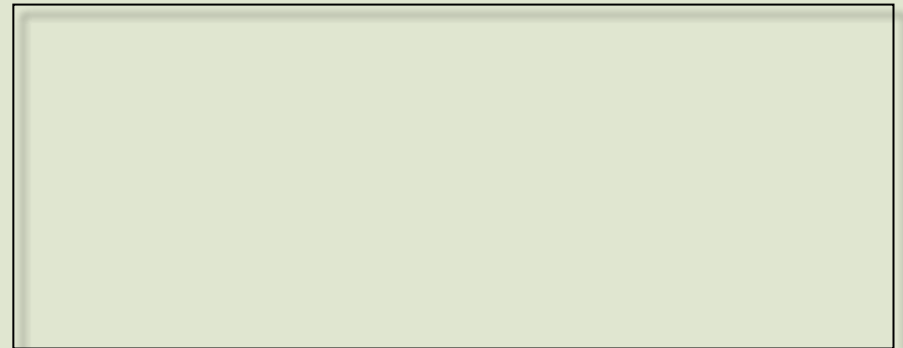
Funding Agency : National Medicinal Plant Board, Ministry of AYUSH, Government of India, New Delhi

Project Team : Jayesh B. Bhatt, Arun Kumar Roy Mahato, Bhagirath R. Paradva and Rakesh A. Poptani

Project Duration : December 2015 to June 2020

Kachchh is one of the country's arid districts, has a rich diversity of medicinal plants, and communities have incredibly wealthy traditional knowledge on these plants to use them to cure their health issues and various diseases. However, documentation of the diversity and distribution of medicinal plants and related traditional knowledge of local people is minimal for the district. Thus, the study was conducted to document the status and distribution of medicinal plants, associated traditional knowledge and economic evaluation of the district's medicinal plant resources for the conservation, management, and sustainable use of medicinal plants. With the stated purpose of the study, the district's diverse habitats, ecosystems, and landscape types were recognized for stratification and sampling locations were identified for intensive surveys. Further, various traditional knowledge holders were interviewed to document indigenous knowledge through a structured questionnaire and consulted with stakeholders for economic evaluation of the district's medicinal

plant resources. The survey recorded 241 ethno-medicinal plants from the district from different habitats, with the highest number of medicinal plant species (117) recorded from the thorny scrubland and the lowest number of species (11) documented in the settlement areas. Among the species recorded, 29 were rare and threatened species. The study identified 12 medicinally important hotspot areas which need to be given special attention to conserve the rich medicinal plant heritage of the district. The final compilation of data and report works are in progress.



10. SUSTAINABLE TAPPING OF GUGGAL (OLEO-GUM-RESIN) FROM *Commiphora wightii*

Funding Agency : The University of Trans-Disciplinary Health Sciences and Technology, Bengaluru

Project Team : Jayesh B. Bhatt, Bhagirath R. Paradva

Project Duration : March 2016 - March 2021

Commiphora wightii (Arnott) Bhandari is a plant of arid region that is greatly regarded for its pharmaceutically important guggul gum-resin as a source of guggulsterone. It is listed in the IUCN Red Data List of Threatened Plants and is now in jeopardy. The population is rapidly depleting its natural habitat, mainly due to over-exploitation, unsustainable and damaging methods of gum extraction coupled with natural dry-arid climate, sluggish growth and poor plant regeneration. Since the main cause of plant extinction is traditional gum harvesting techniques that lead to plant death, the project has been undertaken with a view to preserving and developing a sustainable tapping technique for Oleo-gum-resin extraction and training foresters / guards for sustainable tapping. Two years of experiments with different concentrations of ethophone doses have shown encouraging results, *i.e.*, 103 plants out of 105 have survived after the extraction of gum twice in a year (Summer and Winter). The final experiment to be carried out by selecting samples from different locations.

11. CONSTITUTION OF BIODIVERSITY MANAGEMENT COMMITTEES (BMC) IN RADHANPUR, SANKHESWAR, SANTALPUR TALUKA OF PATAN DISTRICT

Funding Agency : Gujarat Biodiversity Board, Gujarat

Project Team : Arun Kumar Roy Mahato, V. Selvakumar, Jayesh B. Bhatt, Ajay K. Gohel, Bhagirath R. Paradva, Rakesh P. Poptani, Dipmala A. Gajjar

Project Duration : December 2019- March 2021

The Biological Diversity Act, 2002 mandates to set up a Biodiversity Management Committee (BMC) in every gram panchayat of the country. Committee consists of one Chairperson, six members as 1/3rd of the designated women, SC / ST reservation as per state demography. The committee primarily work on documentation of local biodiversity in the form of People Biodiversity Register (PBR). In addition, it is also responsible for the protection and fair use of biological resources and eco-restoring the local biodiversity, appropriate input to the State biodiversity board on Intellectual property rights (IPR), traditional Knowledge and local biodiversity concerns. The Gujarat Biodiversity Board, Gujarat, has authorized GUIDE as the Technical Support Group (TSG) to form Biodiversity Management Committees (BMC) in the district of Patan. GUIDE shall hold village level consultation meetings, conduct training sessions and set up Biodiversity Management Committees in the 117 Gram panchayats of Radhanpur, Sankheswar and Santalpur talukas of Patan District.



12. CONSTITUTION OF BIODIVERSITY MANAGEMENT COMMITTEES (BMC) IN ANJAR, BHACHAU, BHUJ, MUNDRA, GANDHIIDHAM TALUKA, KACHCHH DISTRICT

Funding Agency : Gujarat Biodiversity Board, Gujarat

Project Team : Arun Kumar Roy Mahato, V. Selvakumar, Jayesh B. Bhatt, Ajay K. Gohel, Bhagirath R. Paradva, Rakesh P. Poptani, Dipmala A. Gajjar

Project Duration : December 2019- March 2021

The Gujarat Biodiversity Board, Gujarat has enlisted GUIDE as the Technical Support Group (TSG) for the formation of Biodiversity Management Committees (BMC) in 301 Gram panchayats of Kachchh district. GUIDE shall hold village level consultation meetings, conduct trainings, and constitute the Biodiversity Management Committees in the Gram panchayats in accordance with Section 41 of the Biological Diversity Act, 2002. Committee consists of one Chairperson, six members as 1/3rd of the designated women, SC / ST reservation as per state demography. The committee primarily work on documentation of local biodiversity in the form of People Biodiversity Register (PBR). The BMCs will undertake activities to support the protection, sustainable use and recording of biological diversity, including the conservation of ecosystems, the preservation of genetic resources, folk varieties and cultivars, domesticated stocks and breeds of animals and microorganisms, and detailing of information on biological diversity inside its jurisdiction.



13. PHYTO SOCIOLOGY, DIVERSITY AND DISTRIBUTION OF CLIMBERS IN DRYLAND ECOSYSTEMS OF KACHCHH, GUJARAT

Funding Agency : Women Scientist Programme (DST-WOS-A),
Department of Science and Technology, New
Delhi

Project Team : Dipmala A. Gajjar and Arun Kumar Roy
Mahato (Mentor)

Project Duration : March 2018 - March 2021

Climbers are one of the major groups of plants that play a vital role in different ecosystems and support many species of animals to survive. However, fewer studies have addressed and explored the ecological significance of climbers, their community structure and distribution in different habitats and ecosystems, particularly in dryland areas, compared to other types of vegetation. The floristic diversity of the dryland district faces both natural and anthropogenic threats, such as land degradation, desertification, climate change, industrialisation, pollution, intensive agriculture and invasive alien plant species. Thus, the study is ongoing to explore climber's diversity, its phyto-sociology and community structure, and distribution in various ecosystems of Kachchh district and provide suitable conservation measures. Till now, reconnaissance surveys were conducted to all habitats of Kachchh and a total of 16 grids and 80 quadrates were sampled for data collection on various aspects of the study. A total of 36 species of climbers were recorded from the surveys and some unique association of climbers with other vegetation was also observed.



PROJECT HIGHLIGHTS

DIVISION OF COASTAL AND MARINE ECOLOGY – COMPLETED PROJECTS

1. ASSESSMENT OF PRIMARY PRODUCTIVITY IN THE MARINE WATERS OF KANDLA COAST, KACHCHH, GUJARAT

Funding Agency : Detox Corporation Private Limited, Surat

Project Team : Durga Prasad Behera

Project Duration : March 2019 - May 2019

The Deendayal Port located at Kandla, India established in 1931 by Maharao Khengarji forms a vital marine network for vessels entering India through its Western waters – the Arabian Sea. The aim of this project is to assess Kandla's marine ecological state. The samples were collected from 12 sites and the primary productivity and phytoplankton density were studied within the port area and its periphery. The phytoplankton density varied from 9500 -14500 numbers per litre. A total of 13 phytoplankton genera were encountered during the study period. The dominant species belonged to the genus *Coscinodiscus* and is followed by *Synedra*. The chlorophyll-a and Phaeophytin concentration also estimated along the 12 stations where the concentration was varied from 0.005 to 0.483 mg/m³ and 0.124mg/m³ to 21.49mg/m³, respectively.

2. STUDIES ON SUSPENDED SEDIMENT CONCENTRATION OF KORI CREEK, LAKHPAT, KACHCHH, GUJARAT

Funding Agency : Ocean Science Survey Private Limited, Mumbai

Project Team : Durga Prasad Behera and Rachna Chandra

Project Duration : February 2019 - April 2019

The project's goal was to identify suitable Kori creek marine spread water area for the development of industrial infrastructure. Concentration and salinity analyses of suspended sediments were conducted at 7 locations, where 42 water samples were collected from the surface, bottom and column during low tide as well as high tide by Ocean Science Survey Private Limited, Mumbai. The samples were analysed at GUIDE and results showed a variation in salinity between 35 and 38 ppt whereas the concentration of suspended sediments ranged from 415 to 1056 mg / l; reveals that both parameters are well within the permissible limits of estuarine and coastal waters of GPCB. The study's findings will be used to develop hydro-dynamic model and models for transporting sediments. In addition, the results also contribute to future studies that analyse the creek's hydrodynamic status to expand developmental activities.



3. EXPLORATION OF ENDOPHYTIC MICROORGANISMS FOR NOVEL BIOACTIVE COMPOUNDS FROM MANGROVE ENVIRONMENT OF KACHCHH, GUJARAT

Funding Agency : University Grants Commission (UGC), New Delhi

Project Team : G. Jayanthi, G.A. Thivakaran

Project Duration : April 2014 – April 2019

Mangrove forests occurring at the interface of terrestrial and marine ecosystems represent a rich biological diversity of plants, animals and microorganisms. Microbes, being an important component of the mangrove environment, not only play a very critical role in creating and maintaining this biosphere but also serve as a source of biotechnologically valuable and important products. The project focused on bioprospection of microbial network found in relationship with mangrove (*Avicennia marina*) samples viz., leaf, stem and pneumatophore collected from various mangrove ecosystems in Kachchh district to isolate and characterize the bioactive compound produced from the endophytic microbial strains. The molecular identification utilizing 16SrRNA sequencing of the strong strains proving antimicrobial, antioxidant and enzyme activity belong to the isolate *Cladosporium tenuissimum* (MG430269) and *Memnoniella echinata* (MG430270) which were submitted to NCBI database. The characterized compound JKN1 exhibiting in-vitro anticancer cytotoxicity activity determines a change in cell viability.



DIVISION OF COASTAL AND MARINE ECOLOGY – ONGOING PROJECTS

4. MANGROVE MAPPING THROUGH SATELLITE IMAGERY IN THE ESSAR BULK TERMINAL LIMITED AT HAZIRA, SURAT DISTRICT, GUJARAT

Funding Agency : ESSAR Bulk Terminal Limited, Hazira, Gujarat

Project Team : G. Thirumaran, Dayesh M. Parmar, and Paras Pal

Project Duration : December 2019 to June 2020

The natural mangrove patch is located in between the port expansion area of ESSAR Bulk Terminal Limited (EBTL), towards north side from seashore and west side from Tapi estuary. In order to ensure the ecological health of the natural mangrove stands in the industrial vicinity, Ministry of Environment, Forest and Climate Change (MoEF&CC) has directed EBTL to study the mangrove area through satellite imagery and formulate conservation and management plan. Therefore, EBTL has approached GUIDE to study the mangrove patch through satellite imagery and investigate the long-term temporal mangrove cover changes in the surroundings of EBTL. The mangrove area of approximately 9.6 hectares has increased by a total mangrove area of 46.86 hectares against 37.26 hectares in the last year. Suggestions to reduce the negative effects of sedimentation on mangrove plants were proposed.

5. MARINE ECOLOGICAL STUDIES OF DAMAN COAST

Funding Agency : Ocean Science Private Limited, Mumbai

Project Team : Durga Prasad Behera and S. Sivaraj

Project Duration : June 2019 - December 2020

The aim of this study is to establish the ecological status of coastal water in Daman in order to obtain clearance from the Ministry of Environment and Forest and Climate change (MoEF&CC) to start the oil exploration activities. Thus, 04 sampling locations have been chosen in this regard where the samples will be collected from the bottom (water and sediment) and surface(water). The samples will be examined to quantify the density and abundance of phytoplankton, zooplankton, macro, and meiobenthos. The site's fishing status and peripheral biodiversity will also be calculated by harvesting the fish using cast net operation covering 10/10 square meters of area. Ultimately this baseline information can help to take an appropriate management approach when exploring the oil from this particular area.



6. CLIMATE CHANGE ADAPTATION FOR NATURAL RESOURCE DEPENDENT COMMUNITIES OF KACHCHH DISTRICT ENHANCING RESILIENCE THROUGH WATER AND LIVELIHOOD SECURITY AND ECOSYSTEM RESTORATION- NAFCC PROGRAMME (SEAWEED CULTURE)

Funding Agency : NABARD-GEER Foundation under Gujarat NAFCC Scheme

Project Team : G. Thirumaran, Durga Prasad Behera, K. R. Saravanan, K. Prabhu, S. Sivaraj and Paras Pal

Project Duration : January 2018 – December 2020

National Adaptation Fund for Climate Change (NAFCC) is a government of India's initiative to help communities vulnerable to adverse climate change impacts. State agencies on climate change have been asked to identify and work in the areas sensitive to the effects of climate change. NABARD is the national implementation agency designated for the oversight of activities of the project. GUIDE is the project's implementing partner and promotes the cultivation of seaweed as an alternative livelihood for the fishing community of Kachchh. Seaweeds are India's commercially significant marine living and renewable resources. Seaweed cultivation would allow the creation of industries for the manufacture of agar-agar, algin, carrageenan and biofertilizer in coastal areas, which would help to increase revenues for fishing communities. At Nana Layja, pilot study for the cultivation of seaweed was initiated during February 2020 and tubular net

system with strong monoline rope was used. Seeds of seaweed were deployed in water with 45 tubular nets (3 m each; equals 135 m long to monoline cultivation method). The observations indicate signs of growth with cystcorp emergence.



7. CLIMATE CHANGE ADAPTATION FOR NATURAL RESOURCE DEPENDENT COMMUNITIES OF KACHCHH DISTRICT ENHANCING RESILIENCE THROUGH WATER AND LIVELIHOOD SECURITY AND ECOSYSTEM RESTORATION - NAFCC PROGRAMME (POLY CULTURE)

Funding Agency : NABARD-GEER Foundation under Gujarat NAFCC Scheme

Project Team : G. Thirumaran, Durga Prasad Behera, K. R. Saravanan, K. Prabhu, S. Sivaraj and Paras Pal

Project Duration : January 2018 – December 2020

Polyculture is the method of cultivating more than one species of aquatic organisms in the same unit (marine, freshwater pond, rivers and streams) to meet growing demands. As an implementation partner for the NAFCC climate change adoption project, GUIDE was promoting polyculture as a livelihood alternative for Kachchh fishing community. GUIDE conducted a pilot experiment at Valavarivandh (Abdasa taluka), as directed by the Nodal Agency (GEER Foundation). The availability of fish seeds (milk fish) was explored in the nearby tidal pools of Jabravandh (the closest source to the culture site). Subsequently, pagadiyas were trained to collect wild fish seeds and stocked between February and March 2020.



8. CLIMATE CHANGE ADAPTATION FOR NATURAL RESOURCE DEPENDENT COMMUNITIES OF KACHCHH DISTRICT ENHANCING RESILIENCE THROUGH WATER AND LIVELIHOOD SECURITY AND ECOSYSTEM RESTORATION - NAFCC PROGRAMME (TRAINING AND CAPACITY BUILDING)

Funding Agency : NABARD-GEER Foundation under Gujarat NAFCC Scheme

Project Team : G. Thirumaran, V. Selvakumar, Jayesh B. Bhatt, Durga Prasad Behera, K. R. Saravanan, K. Prabhu, S. Sivaraj and Paras Pal

Project Duration : January 2018 – December 2020

The project aims to enhance the climate change adaptive capabilities of the natural resource-dependent communities by offering the alternative livelihoods that highly coexist with their traditional livelihood options. In this context, the fishermen community of Kachchh has been trained on Community Based Mangrove Restoration, Seaweed Culture and Polyculture to make them resilient towards the adverse impacts of climate change in their traditional livelihoods. During 2019-2020, Five open-training sessions were conducted in villages of Abdasa taluka including Bhangodiwandh, Kosa, Valavarivandh, Mohadi and Jakhau, 309 individuals benefited from engaging and learning about alternative livelihood opportunities that enhance economic resilience and protect them from adverse climate change impacts.



9. CLIMATE CHANGE MITIGATION AND ENHANCING LIVELIHOOD OPTIONS THROUGH SEAWEED CULTIVATION AND CONSERVATION - A MODEL DEVELOPMENT FOR GUJARAT

Funding Agency : Climate Change Department, Gandhinagar

Project Team : G. Thirumaran, K. R. Saravanan, Nakul Bhatt, Paras Pal

Project Duration : March 2019 to February 2022

Seaweed culture is the fastest growing component of global food production, offers a slate of opportunities to mitigate, and adapt to climate change. It can positively reduce CO₂ from the atmosphere relating to the role of ocean ecosystem on blue carbon context. Seaweed cultivation to sequester atmospheric carbon and control climate change is probably the best among climate change mitigation measures. Besides, it has a proven potential as a livelihood option. Despite its high potential in poverty alleviation and climate change control, seaweed culture has not been practiced except for some pilot scale studies and sporadic traditional practices in certain parts of India (Tamilnadu, Kerala & Odisha). Gujarat has the longest coastal state of India which has more potential habitats to standardize and popularize this farming technique. This study attempts to reveal a model for seaweed cultivation that create a livelihood opportunity to coastal populace. The seaweed culture was carried out following monoline and tubular net methods. The seed material was tied using tie-tie method. 10 individuals from fishing community were participated

in the culture activities and plants were monitored regularly and were examined at an interval of 15 days up to 45 days to determine the Daily Growth Rate (DGR). The culture produce was harvested at an interval of 45 days and again the next culture cycle was continued. The seaweed culture was started with small quantity of seed materials of about 7.26 kg (*Kappaphycus alvarezii*) and 1.03 kg (*Gracilaria dura*). After five cycles of culture, 105.5 kg of *K. alvarezii* and 2.36 kg of *G. dura* produce was harvested.



10. REVALIDATION OF MARINE BIODIVERSITY IMPACT ASSESSMENT FOR ADDITIONAL CAPITAL DREDGING AT ADANI KANDLA BULK TERMINAL PRIVATE LIMITED, TUNA

Funding Agency : Cholamandalam MS Risk Services Limited, Chennai

Project Team : K. Prabhu, S. Sivaraj, K.R. Saravanan, Durga Prasad Behera, Paras Pal

Project Duration : January 2020 - March 2020

Revalidation of the impact assessment of marine biodiversity at the Adani Kandla Bulk Terminal Ltd was performed at 3 prefixed dredging sites, 2 disposal sites, intertidal sites and mangrove sites each. The study predicted and illustrated the effects of the project on biotopes and ecosystems. In addition, intertidal fauna, macrobenthos, phytoplankton and zooplankton were also studied. The study reported 19 genera of intertidal fauna such as gastropods, bivalves, crustaceans and Nemertean worms with an overall average density of 216.3 / m². Characterization of different marine biota and habitats in the dredging and disposal sites shows that the study area is pristine and comparable with any normal waters of coastal environment. The expected effects of dredging and disposal operations were insignificant, considering the vastness and carrying capacity of the Gulf.



11. HOLISTIC MARINE ECOLOGICAL MONITORING OF DEENDAYAL PORT ENVIRONMENT WITH SPECIAL REFERENCE TO BIODIVERSITY AND PREPARATION OF MANAGEMENT PLAN

Funding Agency : Deendayal Port Trust, Gandhidham, Gujarat

Project Team : K. Prabhu, K. R. Saravanan, S. Sivaraj, Rachna Chandra, Nikunj B. Gajera, Durga Prasad Behera, Paras Pal, Dayesh M. Parmar

Project Duration : May 2018 - April 2021

Deendayal Port authorities intend to develop seven integrated facilities. because development initiatives of this magnitude will have their own environmental impact. The Ministry of the Environment, Forests and Climate Change (MoEF & CC) has directed the port authorities to conduct regular holistic and comprehensive studies on the marine ecology of the port to record the current status and to conserve its fragile ecosystem through appropriate management plan. The study recorded moderate intertidal fauna diversity in the port area. Macrofaunal communities did not show much spatial variation within their component population. The physico-chemical and hydro-biological characteristics of the ambient environment seem to govern the distribution of the intertidal fauna.



PROJECT HIGHLIGHTS

DIVISION OF ENVIRONMENTAL IMPACT ASSESSMENT – COMPLETED PROJECTS

1. METAL UPTAKE AND STRESS RESPONSES DURING CHELATE ASSISTED PHYTOEXTRACTION PROCESS: EFFECT OF SOIL TYPE, METAL CONCENTRATION AND CO-METAL ION

Funding Agency : Department of Science and Technology (DST),
New Delhi

Project Team : Rachna A. Chandra, Soumya Ranjan Mishra

Project Duration : June 2013 – June 2019

Heavy metals are best known for their toxic properties, mobility, environmental persistence and non-degradability. Contamination of the soil, due to heavy metals, comes from several activities, namely mining, use of chemical fertilisers and pesticides, disposal of industrial effluents as well as solid and hazardous waste, dispersion of contaminants through air. Mining activities have direct contributions to the pollution of heavy metals in soil. The present study adds to the insight about the effect of potential factors on the efficiency of metal accumulation. The soil fraction played an active part in influencing metal accumulation by selected hyperaccumulators. The effectiveness of thiosulphate over thiourea was 1.84 times for BCF, 8.63 times for BAC and 7.48 times for TF. Highest TF value of 7.70 indicates the efficiency of *B. juncea* for Au Phyto mining studies.

2. ECOLOGICAL SURVEY AND FISHERY AS LIVELIHOOD OPTION NEAR BHAVNAGAR, GUJARAT

Funding Agency : H. A. Salt Private Limited, Bhavnagar, Gujarat

Project Team : Rachna Chandra, Nikunj B. Gajera, Durga Prasad Behera

Project Duration : October – November 2019

H. A. Salt Private Limited Ltd., Bhavnagar is a proposed Salt Work unit located in Juna Vadva, Taluka-Bhavnagar, Gujarat. H. A. Salt Pvt. Ltd. approached GUIDE, Bhuj to conduct ecological survey with respect to important species and assess the status of the fishery as a livelihood option in the study area. This constitutes the basis for the present study, which was carried out in and around the proposed area. Five coastal flora species belonging to five families and five genera from core zone were recorded during the survey. A total of 71 avifaunal species belonging to eight orders, 27 families and 56 genera were recorded from the Bhavnagar Port coastal area. Of these, 45 were aquatic and 26 were terrestrial species.



3. MANGROVE BIODIVERSITY ENRICHMENT IN AND AROUND ADANI PORTS AND SPECIAL ECONOMIC ZONE LIMITED (APSEZL), KACHCHH, GUJARAT

Funding Agency : Adani Foundation, Mundra, Kachchh, Gujarat

Project Team : Rachna A. Chandra, K.R. Saravanan

Project Duration : September 2018 – December 2019

Mangrove forests are highly productive ecosystems, which provide numerous goods and services both to the marine environment and people. Gujarat's mangrove cover has grown from 1,140 km² in 2017 to 1,177 km² now and is the country's second largest mangrove cover. The mangroves at Kachchh cover an area of 794.77 km². There are 15 species of mangroves reportedly present at Gujarat. Yet most of Gujarat's stands are single species with *A. marina* while other species are sporadic in distribution. Continuous sources of freshwater in Gujarat are atypical because of topography and climatic settings. Rainfall is a major limiting factor in Gujarat that determines the composition of species, growth and other mangrove vegetation structure. In this context, Adani Foundation contemplated that the establishment of a multi- species mangrove biodiversity park at Mundra would help disseminate knowledge about the mangrove ecosystem and preserve the species. The propagules of *Rhizophora apiculata*, *Ceriops decandra* and *Ceriops tagal* which were procured from the southern part of India during September – October 2018, showed germination of 85-90% in nursery bed raised saplings at Luni

coast. Thus, it is evident that these species have the potential to sustain in Kachchh environment. However, the nursery beds were disturbed due to incidences of camel grazing and cyclone (s). Thus, for the next few years, monitoring and intervening (if necessary) accompanying the plantation area is vital to ensure healthy plant growth.



4. STUDIES ON BIOLOGICAL ACTIVITY OF A FEW INTER-TIDAL AREAS OF THE KANDLA

Funding Agency : Deendayal Port Trust, Gandhidham, Gujarat

Project Team : Rachna A. Chandra

Project Duration : September – October 2019

Deendayal Port (DPT) is an ISO-14001 certified port that adopts a sustainable development policy in order to ensure the concept of “working with nature”. The port wanted to assess the biological activity of few of the patches of intertidal flats adjacent to their existing port operating areas. The terms of reference given by DPT to GUIDE were to evaluate and compare biological activity of the intertidal flats selected by DPT to decide on further course of action based on data available with GUIDE or other organisations in nearby areas. The biological status of four locations as desired by the DPT was assessed along with , data available in nearby areas with GUIDE, data from secondary literature, reports, etc. Total six halophyte species belonging to three families and five genera have been reported. The only prominent species of mangroves was *Avicennia marina*. The TOC content of all four locations in the sediment was < 1%. Compared with the usual density in such an environment, the density of both phytoplankton and zooplanktons from examined locations was considered moderate.



DIVISION OF ENVIRONMENTAL IMPACT ASSESSMENT – ONGOING PROJECTS

5. REGIONAL STRATEGIC IMPACT ASSESSMENT FOR DEENDAYAL PORT REGION

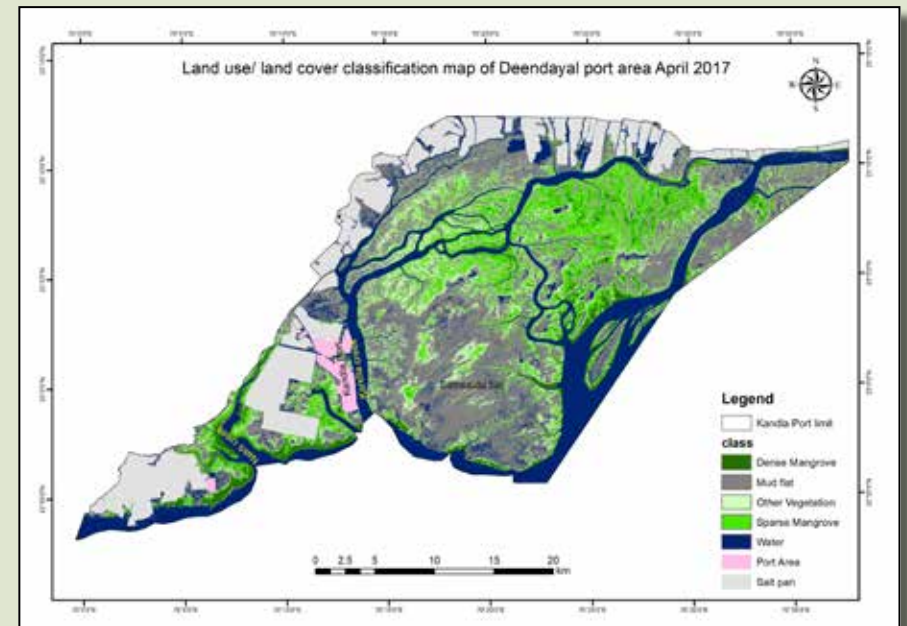
Funding Agency : Deendayal Port Trust (DPT), Kandla, Gujarat

Project Team : Rachna Chandra, Nikunj B. Gajera, Arun Kumar Roy Mahato, Deba Prasad Das, Pratik D. Sengani, Jayesh B. Bhatt, Sonia Benjamin, Dayesh Parmar, Mukesh H. Koladiya, Rakesh Poptani, Bhagirath R. Paradva, Ajay K. Gohel, V. Selvakumar, Viral Vadodariya, Arjan K. Rabari and Hiren V. Chavda

Project Duration : September 2017 - November 2020

Ports are economic tools for the trade and a vital component in the economy of the nation. The marine ecosystem in its vicinity are affected by port activities such as land reclamation, dredging and large-scale construction and expansion. Because of this, the port environment is increasingly gaining attention to make it environmentally sustainable in the face of intense human activity. Deendayal Port in Kachchh District Gujarat State (formerly Kandla Port) operated by Deendayal Port Trust (DPT), is a port gateway to the west and northern Indian hinterland in western and northern states of India. It is one of India 's 12 major ports located at 23° 1' N latitude; 70° 13' E longitude on Kandla creek in the inner part of Kachchh Gulf. DPT has proposed constructing 07 integrated facilities (Stage I) within the existing port facilities. The

Regional Strategic Impact Assessment (RSIA) is conducted based on strategic consideration to devise a regional development policy framework. Such a strategic approach had the main purpose of achieving an environmental regulatory regime in line with the long-term goals of sustainable development in the region.



6. SOURCE-TO-SINK SPATIO-TEMPORAL VARIABILITY IN SEDIMENT FLUXES AND THEIR CONTROL ON COASTAL SEDIMENT DISPERSAL SYSTEMS IN GUJARAT

Funding Agency : Ministry of Earth Sciences (MoES), New Delhi

Project Team : Rachna A. Chandra and Asha V. Sharma

Project Duration : September 2019 – September 2022

In recent times, studies of sediment routing systems have gained considerable attention, since such work helps to understand the forcings on sediment generation, its transit history and accommodation in different geomorphic domains, making natural disturbances more predictable. The study involves multi-institutional expertise to generate understanding of bio-mechanical, bio-chemical and geological controls on the generation of sediments and their flow into the river systems that are in two contrasting climate regimes: the sub-humid Dhadhar River Basin and the arid Chhari River Basin. The release of sediments through the Dhadhar River Basin also controls the coastal sedimentary systems on a macro-tidal regime of the Gulf of Khambhat which is very dynamic in nature and its proper understanding is of prime importance in the context of recent development activities and huge industrial investment. Attempts will be made to validate conventional proxies such as clay mineralogy, heavy minerals, magnetic minerals and geochemistry of sediments in order to understand their dependence on regional, geological and climatic constituents, which has not been studied so far.

7. SOIL QUALITY OF BANNI GRASSLANDS

Funding Agency : Forest Department, Kachchh

Project Team : Rachna A. Chandra, Pratik D. Sengani and Asha V. Sharma

Project Duration : March - June 2020

The increasing number of invasive alien plants is considered as a primary threat to the integrity and function of ecosystem. Banni region, Kachchh, was once the largest grassland in Asia. However, *Prosopis juliflora*, an invasive mesquite species, has invaded many parts of Kachchh, wherein the highest rate of invasion is reported in the Banni grassland. Inherent salinity in most part of Kachchh grasslands is a major problem and is aggravated due to climatic abnormalities. *Prosopis juliflora* has further affected the condition in Banni region. The Forest Division, Bhuj approached GUIDE to analyse soil samples of Banni region. The samples were collected by the Forest Department and will be analysed at GUIDE. The samples have been dried at room temperature. Physico-chemical parameters of soil will be analysed following standard methods.

DIVISION OF NATURAL RESOURCE MANAGEMENT – COMPLETED PROJECTS

1. TRAINING OF INTEGRATED WATERSHED MANAGEMENT PROGRAMME (IWMP) PROJECT IN KACHCHH

Funding Agency : Gujarat State Water Shed Management Agency (GSWMA), Gandhinagar, Gujarat

Project Team : Prakash M. Patel, Geeta R. Goswami, Amit. J. Ghodasara and Jayrajsinh R. Mori

Project Duration : August 2016 - March 2020

Watershed Development Programme (WDP) is aimed for a holistic and sustainable development of an area and its population-based on conservation, management and development of the natural resource base of the watershed. Gujarat State Watershed Management Agency (GSWMA) is the state's nodal agency for the implementation of the Integrated Watershed Management Program (IWMP), and its mandate includes both directly and indirectly planning and development of all watersheds. GSWMA under the Commissionerate of Rural Development has sanctioned Watershed training project to GUIDE. The project's primary goal is to build capacity for farmers, self-help groups (SHGs), and Village Water Committees (VWCs), and raise awareness about GSWMA rules. In total, 38 training sessions with participatory activities have been arranged and 3,840 villagers were benefited.



DIVISION OF NATURAL RESOURCE MANAGEMENT – ONGOING PROJECTS

2. INTEGRATED WATERSHED MANAGEMENT PROGRAMME (IWMP) - 41

Funding Agency : District Watershed Development Unit (DWDU), Kachchh, Gujarat

Project Team : Prakash M. Patel, Geeta R. Goswami, Amit. J. Ghodasara and Jayrajsinh R. Mori

Project Duration : June 2013 - May 2020

Integrated Watershed Management Program (IWMP) is a program designed and planned scientifically, and implemented in a sustained way. It provides a complete techno-managerial and social solution to local community issues related to the livelihood. The villages including Bhuvad, Kumbhariya, Valadiya (East) and Valadiya (West) covering an area of 7,035 ha in Anjar taluka of Kachchh district benefit from this project. The farmers in these villages mostly practice rain-fed agriculture. The major problems of the project area are degraded soil, climatic constraints, low soil fertility, soil erosion, reduced vegetative coverage, water shortages, soil and water salinity resulting in soil degradation and productivity. The integrated project aims to improve the status of the land through various soil, water and other site-specific modifications, consequently improving the socioeconomic status of the villagers.

3. INTEGRATED WATERSHED MANAGEMENT PROGRAMME (IWMP) – 44

Funding Agency : District Watershed Development Unit (DWDU), Kachchh, Gujarat

Project Team : Prakash M. Patel, Geeta R. Goswami, Amit. J. Ghodasara and Jayrajsinh R. Mori

Project Duration : September 2017 - March 2022

The Integrated Watershed Management Programme (IWDP) -44 was introduced and is under progress in the village Desalpar of Rapar Taluka. The project has aimed to improve water management in the project villages by covering an area of 4,684 ha. The Project area lies along the Kachchh Rann fringes. This integrated project aims to improve the land status through diverse soil, water, and other site-specific improvements, thus helping to strengthen the villagers' socio-economic status.



4. INTEGRATED WATERSHED MANAGEMENT PROGRAMME (IWMP) – 49

Funding Agency : District Watershed Development Unit (DWDU), Kachchh, Gujarat

Project Team : Prakash M. Patel, Geeta R. Goswami, Amit. J. Ghodasara and Jayrajsinh R. Mori

Project Duration : September 2017 - March 2022

The watershed project (IWDP - 49) is being implemented in the villages located in the Mandvi taluka including Bayath, Changday, Bambhaday, Maper covering an area of 6042.60 ha. The project's central objective is to restore ecological equilibrium by harnessing, maintaining and further improving the depleted natural resources such as soil, vegetative cover and water. The project is in progress.



5. IRESTORATION OF WATER HARVESTING STRUCTURES UNDER GUJARAT NAFCC PROJECT

Funding Agency : NABARD - GEER Foundation under Gujarat NAFCC Scheme

Project Team : Prakash M. Patel, Arun Kumar Roy Mahato, Geeta Goswami, Amit. J. Ghodasara and Jayrajsinh R. Mori and Ajay K. Gohel

Project Duration : March 2018 - March 2021

Kachchh, a drought-prone region situated in western India, has unique geographical features, with sea and desert. The project aims to rebuild the water storage systems to improve the adaptation ability of the communities to combat climate change. The interventions will help in soil run-off prevention, natural vegetation regeneration and reviving the groundwater table. It will further rejuvenate the agro-based activities and improve quality of life of the local communities. In total, 38 water harvesting structures have been completed in the project villages.



PROJECT HIGHLIGHTS

DIVISION OF ENVIRONMENTAL LABORATORY – COMPLETED PROJECTS

1. PERFORMANCE EVALUATION OF AIR POLLUTION CONTROL SYSTEM OF M/S ASHAPURA PERFOCLAY LIMITED (APL)

Funding Agency : Ashapura Perfoclay Ltd (APL)

Project Team : K. Karthikeyan, Ratansi M. Chaudhary, Anjali Thomas

Project Duration : February – March 2020

Ashapura Perfoclay Limited (APL) is manufacturing Bentonite and Clay based value added products in India. The company approached GUIDE to do the 'Third Party Performance Evaluation of Air Pollution Control System' based on their non-compliance of Environment Clearance-EC condition put forth by SEIAA, Gujarat. As GUIDE has been recognised as Schedule-I Environment Auditor of the Gujarat Pollution Control Board, Ashapura Perfoclay Limited was audited from 16th to 18th May, 2020. The audit team did a thorough study of the plant, it's raw material intake, conveyor belts, feeding section, rotary kiln area, boiler area, stack area, pulverization and packing sections. Monitoring of ambient air was carried out covering the plant in all directions, following the performance assessment of the air pollution control systems provided at the premises of Ashapura Perfoclay Limited. The environmental audit team of GUIDE certified that the system is adequate and efficient to meet the requirements of the Gujarat Pollution Control Board.



2. MONITORING OF GROUNDWATER AND EFFLUENTS FROM TEXTILE DYEING UNITS OF DIFFERENT TALUKA OF KACHCHH, GUJARAT

Funding Agency : Hunnarshala Foundation, Bhuj-Kachchh

Project Team : K. Karthikeyan, T. Dhananjayan, Hirji K. Dangar,
Monika R. Sharma, Ami D. Lakhani, Raj A. Joshi

Project Duration : April 2016 – March 2019

Textile dyeing and printing is one of the traditional industries of Kachchh. The Hunnarshala Foundation, a Kachchh-based organization working with artisans, has approached GUIDE to study the quality of ground water in the surrounding areas of dyeing units located in various locations of the Kachchh district, such as Anjar, Mundra, Mandvi, Bhuj, Ajrakhpur, Dhamadka, Nagore Road. The researchers from GUIDE has collected the groundwater samples and analyzed for their physico-chemical characteristics including examining of textile intermediates using GC-MS . The results of this analysis were compared with the water quality standards of BIS. In this analysis various physio-chemical parameters such as pH, Electrical Conductivity, Turbidity, Total Dissolved Solids, Turbidity, Chlorides, etc., were determined using Standard Procedures. The quality of Groundwater samples was discussed with respect to these parameters.



3. MARINE ECOLOGICAL STUDIES FOR REVAMPING PIPELINES OF OIL JETTIES OF DEENDAYAL PORT TRUST, KANDLA, GUJARAT

Funding Agency : Metallurgical & Engineering Consultants Limited (MECON Ltd.), A Public Sector undertaking under the Ministry of Steel of the Government of India, Ranchi, Jharkhand

Project Team : K. Karthikeyan, G. A. Thivakaran, K. Prabhu, Durga Prasad Behera, Dayesh M. Parmar, Raj A. Joshi, Jayanti. P. Barot

Project Duration : May 2018 – September 2019

Deendayal Port authorities intend to replace the oil jetty pipelines with new ones with higher capacity and safety measures. MECON Limited, a Government of India Enterprise located at Ranchi, Jharkhand has been assigned the task of replacing pipelines from oil jetties 2, 3 and 4. While according environmental clearance to this project, it was mandated by Ministry of Environment, Forests & Climate Change (MoEF & CC), New Delhi that a detailed Environmental Impact Assessment (EIA) and Management Plan (EMP) to be carried out. GUIDE has been assigned the task of conducting the marine ecological studies. Ten sampling sites were identified for collection of phytoplankton and zooplankton, intertidal, subtidal macro, and meiofauna. In addition, samples were collected for study of the mangrove from 12 locations across the Kandla creek and results submitted with adequate suggestive measures to conserve the project area.



DIVISION OF ENVIRONMENTAL LABORATORY – ONGOING PROJECTS

4. MARINE MONITORING STUDIES AT CRUDE OIL TERMINAL (COT) OF BORL, VADINAR, GUJARAT

Funding Agency : Bharat Oman Refineries Limited, Jamnagar, Gujarat

Project Team : K. Karthikeyan, K. Prabhu, Durga Prasad Behera, S. Sivaraj, T.Dhananjayan, Hirji Dangar, Monika Sharma, Ami D. Lakhani, Dipti L. Parmar

Project Duration : August 2019 – August 2022

Marine Environmental health of the Crude Oil Terminal and the SBM of Bharat Oman Refineries Limited (BORL) was entrusted to GUIDE since 2011. The current location of the study is on the southern shore of the Gulf of Kachchh (GoK), approximately 50 km west of Jamnagar. BORL's Single Buoy Mooring (SBM), located approximately 7 km from its berths, allows super tankers to transfer crude oil to shore-based storage structures through the use of pipeline systems. To preserve environmental health and to further understand the sensitive nature of the adjacent marine environment, BORL authorities have instituted a holistic study to track significant changes in ecology and environment due to ongoing activities. In this relation, GUIDE has been conducting monthly monitoring studies since August 2011. This ecological study includes analysis of quality of water and sediments, biological quality, intertidal and subtidal fauna and plankton.

5. MARINE MONITORING STUDIES AT CRUDE OIL TERMINAL (COT) OF NAYARA ENERGY LIMITED, VADINAR, GUJARAT

Funding Agency : Nayara Energy Ltd. (Formerly ESSAR Oil Ltd), Jamnagar

Project Team : K. Karthikeyan, K. Prabhu, Durga Prasad Behera, S. Sivaraj, T. Dhananjayan, Hirji K. Dangar, Monika R. Sharma, Ami Lakhani

Project Duration : April 2019 - March 2022

In order to facilitate the supply of crude oil to the refinery, Essar Oil Refinery established, a marine terminal termed as Vadinar Oil Terminal Limited (VOTL) comprising SPM, product berths, pipelines etc. The Marine Terminal's entire marine operations are executed via VOTL located at Vadinar. To monitor Vadinar's Marine environment, VOTL has given GUIDE the task of monitoring and evaluating the marine ecological status of the environment at critical locations in and around the terminal and its offshore facilities. In this regard, GUIDE was entrusted with tenth consecutive year of monthly monitoring of select area in Vadinar coastal belt.



6. ENVIRONMENTAL AUDIT FOR SCHEDULE-I INDUSTRIES

Funding Agency : Industries (As per GPCB guidelines)

Project Team : Dr. K. Karthikeyan,
Ratansi Chaudhary,
Anjali Thomas,
Mahesh. P. Dafda, (Till 3rd June 2019),
Harsh H Bhatt (August – September 2019),
Dhara H. Mehta (November 2019 - March 2020)

Project Duration : January 2015 – December 2020

GUIDE since 2014 is recognized as Schedule-1 Environmental Auditor by Gujarat Pollution Control Board (GPCB), Gandhinagar to conduct Environmental Audit of Industries in Gujarat. Environmental Audit is basically a management tool which comprises of an organized evaluation procedure for performing the Environmental Management protocols in an industrial setup in order to ensure waste prevention, waste reduction and to maintain other regulatory compliances. The major task of the Environmental Auditors is to monitor and evaluate the Environmental Management System (EMS), suggest and recommend necessary improvement of EMS in the industries and informing all these activities in the public domain. With the above-mentioned objectives, this scheme is being functional since last 10 years being implemented by GPCB through various Recognized Environmental auditors (Schedule – I and II). GUIDE is one among the 34 Schedule - I Auditors in the state. Environmental

audits are undertaken on seasonal basis, i.e., thrice in a year which includes Ambient Air monitoring, Stack monitoring, Water, Wastewater, STP and trade effluent analysis, Hazardous waste characterization Noise monitoring. The audit work intends to gather information on the industrial processes adopted by the system. During the financial year 2019-2020,13 industries have been allotted to GUIDE based on XGN random allotment by GPCB.



7. STUDIES ON DREDGED MATERIAL FOR THE PRESENCE OF CONTAMINANTS (EC & CRZ Clearance accorded by the MoEF&CC, GoI dated 19/12/2016- Specific Condition no. VII)

Funding Agency : Deendayal Port Trust, Gandhidham, Gujarat

Project Team : K. Karthikeyan, G. Thirumaran, G. Jayanthi, K. Prabhu, S. Sivaraj, Dayesh Parmar, T. Dhananjayan, Hirji. K. Dangar, Monika R. Sharma, Ami D. Lakhani, Dipti L.Parmar, Keyur Modi

Project Duration : November 2018 – November 2021

Deendayal Port authorities intend to initiate development activities and have approached the Ministry of Environment, Forests and Climate Change (MoEF & CC) for environmental clearance. Accordingly, MoEF & CC directed the port authorities to carry out 'Studies on dredged materials for the presence of contaminants' under the EC & CRZ Clearance granted by the MoEF & CC, GoI dated 19/12/2016, Specific Condition No. VII. In this context, DPT approached GUIDE to study two specific dumping locations for a period of three years. This study contemplates the evaluation of the physico-chemical characteristics of dredged materials in dumped locations as outlined by "The Central Water and Power Research Station (CWPRS), Pune.



8. CULTIVATION OF MEDICINAL MUSHROOM, *Cordyceps Militaris*: A PILOT SCALE STUDY

Funding Agency : Inhouse project of GUIDE

Project Team : Dr. G. Jayanthi and Ms. Monika R Sharma

Project Duration : December 2019 – March 2020

Dr. Jayanthi, Scientist of GUIDE has conducted a pilot scale cultivation of *Cordyceps militaris* with the technical inputs of Dr. K. Karthikeyan and with the lab level support of Ms. Monika R. Sharma. *Cordyceps militaris* is an entomopathogenic fungus that is often used as a traditional medicine developed out of ancient wisdom in Asia. Cordycepin currently from *C. Militaris* is of great interest to medicinal uses. This mushroom is known to be one of the costliest available on the market, due to the medicinal values. Therefore, development of scalable, cultivation techniques can help the small mushroom growers. Keeping this in mind, the Gujarat Institute of Desert Ecology (GUIDE) made an initial pilot scale attempt to produce the medicinal mushroom, *C. Militaris*, by scalable processes. The pure culture was inoculated in selective broth to proliferate and produce liquid spawn. After 90 days, the mushroom was harvested, and about 340 grams of dried *C. Militaris* was harvested. In the near future, GUIDE will train mushroom growers on *Cordyceps militaris*' cultivation techniques to increase profitability and improve the quality of life.



EVENTS IN GUIDE

Save The Frogs Day

Save The Frogs Day was observed on 1st May 2019 at GUIDE to increase an awareness about frogs: amphibians found on land and water both. Frogs are predators and play a vital role in sustaining the environment during its lifetime. Extinction of frogs is a serious threat and is instigated by many reasons such as deforestation, low rainfall and decrease in water bodies etc. As part of the event, Dr. Arun Kumar Roy Mahato delivered a talk on “Most Threatened class of Vertebrates”. Senior officials from Arid Communities and Technologies (ACT), Bhuj-Kachchh also attended the event.



International Day for Biological Diversity

International Biological Diversity Day was celebrated on 22nd May 2019, in which Dr. V. Vijay Kumar delivered a special talk on “Gandhiji and Environment” and emphasized the need of adapting Mahatma’s idea of Vasudhaiva Kutumbakam (the world is one family) as a solution to address the environmental issues of the century. In addition, Dr. Arun Kumar Roy Mahato delivered a data

backed technical talk on “Biodiversity Crisis”. His talk centred on the importance of conservation of biodiversity and its nexus with various ecological components and food security.



World Environment Day

World Environment Day was celebrated on 5th June 2019. As part of the event, plantation activities were undertaken in GUIDE campus. Dr. V. Vijay Kumar and Dr. K. Karthikeyan attended the environmental day celebration organised by Jindal Saw Limited, Mundra, Kachchh.



World Mangrove Day

GUIDE has organized the “International day for the conservation of mangrove ecosystems on 26th July 2019” which was attended by representatives from Forest Department, Kachchh. In this event, Dr. K. R. Saravanan delivered a talk on “Wondrous Mangrove” and Dr. Rachna Chandra delivered a talk on “Multi-species Mangrove Restoration activities by GUIDE”.

Great Backyard Bird Count – India

GUIDE has taken part in the Campus Bird Count 2020 as a part of Great Backyard Bird Count – India organized on 14th to 17th February 2020.

Coastal Clean Seas Campaign

The Coastal Clean Seas Campaign as part of the “International Coastal Clean-up Day” and “Swachh Bharat Abhiyan” was celebrated on 21st September 2019 at Mandvi beach, Kachchh. The objective of the program is to engage and create awareness on the importance of the coast and to become better stewards of our environment. GUIDE conducted the program in collaboration with the National Centre for Coastal Research (NCCR), Chennai. Under the direction of Dr Vijay Kumar, Director of GUIDE, Campaign was coordinated by Dr Durga Prasad Behera, Project Scientist, GUIDE.

The Senior Scientists of GUIDE Dr. K. Karthikeyan and Dr. K. R. Saravanan presided and explained the moto of the cleaning drive. Range Forest officer Mr. K.N Kher inaugurated the campaign along with Sri R.M Zala, RFO Social forestry (Retd) and Mr Soni from

Nagarpalika of Mandvi. 120 student volunteers from R.H.P Higher Secondary School, Maska, Khimji Ramdas Kanya Vidhyalay, Coast Guard school, Government Science college of Mandvi along with the researchers from GUIDE, the workers from the Mandvi municipality and the tourists were part of the event. The volunteers went as rally to sensitize the local communities on plastic pollution and collected the plastic waste along the coast. The volunteers collected 480 kg of plastic garbage and the same was safely disposed by the Mandvi Municipal solid waste management team.



National Conference on “Plastics in the Environment: Current Status and Rethinking the future of plastics

Gujarat Institute of Desert Ecology, Bhuj, Gujarat has organised a National Conference on “Plastics in the Environment: Current Status and Rethinking the future of plastics” that held on 7th March 2020. Dr. K. Kadirvelu, DRDO Coordinator & Joint Director, DRDO-BU Center for Life Sciences, Bharathiar University Campus, Coimbatore, Tamilnadu delivered a key note address on “Occurrence and identification of microplastics (MP’s) in the major wetlands of Coimbatore, Tamil Nadu, India and unveiling their toxic properties on animal and plant models”. In addition, Dr. Mrugesh H. Trivedi, Assistant Professor in Environmental Science, Department of Earth and Environmental Science, KSKV Kachchh University, Bhuj, Gujarat; Prof. P. Lakshmanaperumalsamy, Former UGC Emeritus Professor, Department of Environmental Sciences, Bharathiar University, Coimbatore, Tamilnadu and Ms. Rajeshwari Singh, Managing Director, Caravan Classroom, Vadodara, Gujarat have shared their critical understanding related to plastics and its interaction with other life systems. Further, 10 oral and 35 poster presentations has been delivered by the faculty, scientists, Researchers and students from various parts of the country.



GUIDE'S COLLABORATIONS (Past and Present)

MoU / International Collaborations

- Blaustein Institutes for Desert Research (BIDR), Israel
- Institute of Development Studies, University of Sussex, Brighton, UK
- Massey University, North Palmerston, New Zealand
- Norwegian University of Life Sciences, Norway
- The University of Greenwich, London, UK
- Le Centre National De La Recherche Scientifique (CNRS) and Centre d'Ecologie Fonctionnelle et Evolutive (CEFE), Montpellier

MoU / National Collaborations

- Institute of Trans-Disciplinary Health Sciences and Technology (ITDHST), Trans Disciplinary University (TDU), Bengaluru
- S.P. University, Anand, Gujarat
- Indomer Coastal Hydraulics Private Limited., Chennai
- ICAR-Central Institute for Brackish Water Aquaculture (CIBA), Chennai
- The Centre of Advanced Study in Marine Biology, Annamalai University, Chidambaram, Tamil Nadu
- C.C. Shroff Research Institute, Mandvi – Kachchh, Gujarat
- Central Arid Zone Research Institute (CAZRI), Jodhpur, Rajasthan

- Central University of Rajasthan (CURAJ), Ajmer, Rajasthan
- Centre for Advanced Study in India (CASII), Bhuj, Gujarat
- CSIR - National Environmental Engineering Research Institute (NEERI), Nagpur, Maharashtra
- CSIR - National Geophysical Research Institute (NGRI), Hyderabad
- Gujarat Environmental Management Institute (GEMI), Gandhinagar, Gujarat
- Gujarat National Law University, Gandhinagar, Gujarat
- Institute of Science and Technology for Advanced Study and Research (ISTAR), S.P. University, Vallabh Vidyanagar, Gujarat
- K.S.K.V. Kachchh University, Bhuj-Kachchh, Gujarat
- Knowledge Consortium of Gujarat (KCG), Gandhinagar, Gujarat
- Pandit Deendayal Petroleum University (PDPU), Gandhinagar, Gujarat
- SANDHAN, Gandhinagar, Gujarat
- Network for Certification and Conservation of Forests (NCCF)



INTERNATIONAL, NATIONAL MEMBERSHIPS AND RECOGNITIONS (Past and Present)

GUIDE is an active member in several national and international programmes in the area of climate change, biodiversity conservation, combating desertification, etc. Additionally, GUIDE has recognitions at various levels with many organizations and has been recognized in many fields.

Memberships

- Global Network of Dryland Research Institutes (GNDRI), Israel
- International Society of Zoological Sciences (ISZS), China
- International Union for Conservation of Nature (IUCN), Switzerland
- Ocean Expert, Intergovernmental Oceanographic Commission of UNESCO
- International Hydrological Programme (IHP)
- Eco sensitive International Hydrological Programme (IHP)

Committees

- District Environment Impact Assessment Authority (DEIAA), Kachchh
- Eco-sensitive zone committee of Girnar Wildlife Sanctuary, Junagadh
- Eco-sensitive zone committee of Marine National Park and Sanctuary, Jamnagar
- Eco-sensitive zone committee of Kutch Bustard Sanctuary
- Eco-sensitive zone committee of Narayan Sarovar Sanctuary
- District Expert Appraisal Committee (DEAC), Kachchh

Recognitions

- GUIDE is an Expert Organization on 'Combating Desertification' recognized by the ENVIS Centre on Combating Desertification, hosted by CAZRI and sponsored by MoEF & CC, Govt. of India, New Delhi.
- GUIDE is recognized as Environmental Auditors for Schedule - I Industries of Gujarat by the Gujarat Pollution Control Board (GPCB), Gandhinagar.
- GUIDE is recognized as Scientific and Industrial Research Organization (SIRO) by the Department of Science and Technology (DST), Govt. of India, New Delhi.
- GUIDE laboratory was recognized as State Air & State Water Laboratory by the Gujarat Pollution Control Board (GPCB), Government of Gujarat, Gandhinagar.
- Education and Research Institute by the K.S.K.V. Kachchh University, Bhuj.

Accreditations

- National Accreditation Board for Testing and Calibration Laboratories (NABL), Quality council of India in the field of chemical testing as per ISO / IEC 17025:2005

Awards

- Kutch Ratna Award for Environment by K.S.K.V. Kachchh University, Bhuj, Gujarat
- National Education Leadership Award by Dainik Bhaskar, Mumbai



CONSULTANCY SERVICES OFFERED BY GUIDE'S ENVIRONMENTAL LABORATORY DIVISION FOR VARIOUS ANALYSIS

1. A&C Enterprise, Bhuj
2. Agrocel Industries Limited, Quality Control Department, Dhordo, Kachchh
3. Agrocel Industries Pvt. Ltd, Bhuj
4. AMW Auto components Ltd, Bhuj - Bhachau Road, Kachchh
5. Arid Communities and Technologies, Bhuj – Kachchh
6. Ashapura International Limited
7. Ashapura Perfoclay Ltd.
8. Bunge India Pvt. Ltd.
9. Balkrishna Industries Ltd, Bhuj
10. C. C. Shroff Research Institute, Mandvi
11. Centre for Advanced Studies in Marine Biology, Annamalai University, Tamilnadu
12. Dept. of Chemical Engineering, Government Engineering College, Bhuj
13. Dept. of Chemistry, KSKV Kachchh University, Bhuj
14. Dept. of Earth and Environmental Sciences, KSKV Kachchh University, Bhuj
15. Dept. of Env. Sciences, PSG College of Arts and Science, Coimbatore.
16. Dept. of Environmental Engineering, Government Engineering College, Bhuj
17. District Watershed Development Unit, Bhuj
18. Dorf Ketel Speciality Catalyst Pvt. Ltd., Adani Port & SEZ, Mundra.
19. Geeta Cooling System, Bhuj – Kachchh
20. Gorasiya Farms, Kachchh
21. Greencindia Consulting Private Ltd., Ghaziabad
22. Gujarat Mineral Development Corporation Ltd., Lakhpat, Kachchh
23. Gujarat State Forest Development Corporation, Kachchh.
24. Haresh Construction Co, Mundra.
25. Hunnarshala Foundation, Bhuj-Kachchh.
26. ILARK Hotel, Bhuj
27. Innovation and Knowledge Centre, Ashapura Minechem Ltd. Bhuj
28. Irrigation Department, Bhuj
29. JB Envirotech, Bhuj
30. Kalinga Watertech Pvt. Ltd
31. M & N. Virani Science College, Rajkot
32. Nalanda Engicon Pvt. Ltd., Bhuj
33. Phillips Carbon Black Ltd, Mundra
34. Satvik: Promoting Ecological Farming, Bhuj.
35. Satyesh Brine Chem. Pvt. Ltd
36. Sejwala Matham, Bhuj
37. Shakthi Water Supply, Bhuj Road, Mundra– Kachchh
38. Shiv Hydreomet, Rajkot.
39. SPM Arogyadham, Bhuj
40. Suzlon Energy Limited, Nakhatrana, Kachchh
41. Suzlon Global Services Ltd.
42. SVCT House, Bhuj
43. Top Build Concrete Pvt, Ltd. Dhunai, Mandvi – Kachchh .
44. USB Chemicals, Bhuj.
45. Vivekanad Rural Development Institute, Mandvi – Kachchh
46. Welspun Corp Ltd I Pipe Division, Anjar
47. Welspun India Pvt. Ltd., Anjar, Kachchh.
48. Jagnath Lab Technolgies, Rajkot
49. Range Forest Office, Nakhatrana East Range, Kachchh
50. Happy Homes & Hari Om, Bhuj





IMPORTANT VISITORS



- Dr. Petter Vilsted, Norfund, Oslo and Mr. Emanuele Polimanti, Enel green Power, Italy
- The Joint Secretary and Officials, Climate Change Department, Gandhinagar.
- Dr. Rajendrasinh Jadeja, The M. S. University of Baroda, Vadodara.
- Dr. S. N. Tyagi, APCCF and his team, Forest Research Institute, Gandhinagar.
- Dr. Swaroo Iyer, Dr. Suvalaxmi Sen and Dr. Ghoshal Kanishka, ENEL, Haryana.
- Dr. Arun Venkatraman, Technical Director and Dr. Karunakaran Nagalingam, Principal Consultant, ERM India Pvt Ltd., Haryana.
- Dr. Lyla Mehta, IDS, Sussex University, UK.
- Dr. Nobu Ohte and Dr. Ronitit Chartterjee, Kyoto University, Japan.
- Dr. Dolly Daftary, Researcher, USA

Students visit to GUIDE

As a part of the curriculum, the higher secondary science students (20 students) of Chanakya Academy, Bhuj had visited the various units of the Environmental Laboratory Division of GUIDE on 7th December 2019. 32 Students and 5 faculty members from Department of Botany, C. C. S. University, Meerut, Utter Pradesh visited GUIDE on 29th February 2020. Also, 4 Faculty Members and 30 Students from TERI University, New Delhi visited GUIDE on 2nd March 2020. Dr. V. Vijay Kumar, Dr. Arun Kumar Roy Mahato, Biodiversity and grassland experts from KSKV Kachchh University and Forest Department were part of the event.



PUBLICATIONS

Research Papers

Pandey, A., and A.K.R. Mahato (2019) Restoration potential of degraded inland sacred forest of Kachchh, Gujarat. *International Journal of Pharma and Bioscience*, 10(3B), 171-180.

Bharathidasan, V., Rajesh, N., Murugesan, P., & Sivaraj, S. (2020). Microscopic visualization of regeneration in scale worm *Paralepidonotus* sp. (Grube, 1878). *Indian Journal of Experimental Biology*, 58(05), 360–364. **IF: 0.783.**

Gajera, N and Koladiya, M. (2019). Mammalian species distribution and diversity in arid region of Kachchh, Gujarat. *International Journal of Zoology Studies*, 4 (4), 27-33.

Hiren B. Soni, V. Vijay Kumar and P. N. Joshi (2019). Environmental Impact Assessment and Environmental Management Plan: A Case Study of Kachchh, Gujarat, India. *Current World Environment*, 14 (1), 99-127.

Li, L., Su, L., Cai, H., Rochman, C. M., Li, Q., Kolandhasamy, P., ... & Shi, H. (2019). The uptake of microfibers by freshwater Asian clams (*Corbicula fluminea*) varies based upon physicochemical properties. *Chemosphere*, 221, 107-114. **IF: 5.778**

Mehta, L., Srivastava, S., Adam, H. N., Bose, S., Ghosh, U., & Kumar, V. V. (2019). Climate change and uncertainty from 'above' and 'below': perspectives from India. *Regional Environmental Change*, 19(6), 1533-1547. **IF: 2.02.**

Mishra, S. R., Chandra, R., & Prusty, B. A. K. (2020). Chelate-assisted phytoaccumulation: growth of *Helianthus annuus* L., *Vigna radiata* (L.) R. Wilczek and *Pennisetum glaucum* (L.) R. Br. in soil spiked with varied concentrations of copper. *Environmental Science and Pollution Research*, 27(5), 5074-5084. **IF: 3.056.**

Prusty, B. A. K., Chandra, R., & Azeez, P. A. (2019). Association of metals with geochemical phases in wetland soils of a Ramsar site in India. *Environmental monitoring and assessment*, 191(12), 715. **IF: 1.903.**

Ramanuj, R. M and V. Vijay Kumar (2019). Appraisal of Ground Water prominence in Bhuj (Kachchh), Gujarat (India) For its Imbibing and irrigation use. *International Journal of Applied Engineering Research* 1320,14775-14786.

Sigamani, S., Perumal, M., Thivakaran, G. A., Thangavel, B., & Kandasamy, K. (2020). DNA barcoding of macrofauna act as a tool for assessing marine ecosystem. *Marine pollution bulletin*, 152, 107891.

Thakur, K., K. Karthikeyan, G. A. Thivakaran, H.B. Soni and V. Vijay Kumar. (2020). Interlinking association between Red-clawed Crab, *Perisesarma bidens* (De Hann, 1835) and Grey Mangrove, *Avicennia marina* (Forsk.) Vierh. In Nakti Creek (Gulf of Kachchh), Gujarat, Western India.

Vellingiri, S., Dutta, P., Singh, S., Sathish, L. M., Pingle, S., & Brahmabhatt, B. (2020). Combating climate change-induced heat stress: Assessing cool roofs and its impact on the indoor ambient temperature of the households in the urban slums of Ahmedabad. *Indian Journal of Occupational and Environmental Medicine*, 24(1), 25-29.

Book

- R., Chandra, V. Vijay Kumar, & Rakshit Shah. (2020). *Multi-species Mangrove Biodiversity Park in Kachchh, Gujarat*. Gujarat Institute of Desert Ecology, Bhuj and Adani Foundation, Mundra.



BOARD OF GOVERNORS

Sr. No.	Name	Designation
1	Sh. S. G. Mankad, IAS (Retd.), Former Chief Secretary of Gujarat State	Chairman
2	Ms. Vijaylaxmi Sheth, IPS (Retd.), Former Chief Post Master General of Gujarat State	Vice Chairman
3	Shri. P. K. Taneja, IAS (Retd.), Director General, Gujarat Institute of Disaster Management (GIDM), Gandhinagar, Gujarat	Member
4	Dr. Dinesh Misra IFS (Retd.), Former Principal Chief Conservator of Forests (Head of Forest Force)	Member
5	The District Development Officer, Kachchh District, Gujarat	Member
6	Prof. R. Parthasarathy, Director, Gujarat Institute of Development Research (GIDR), Ahmedabad, Gujarat	Member
7	The Vice Chancellor, Krantiguru Shyamji Krishna Verma Kachchh University, Bhuj, Gujarat	Member
8	Prof. Geeta Padate, Maharaja Sayajirao University of Baroda , Vadodara, Gujarat	Member
9	The Member Secretary, Gujarat Pollution Control Board (GPCB), Gandhinagar, Gujarat	Member
10	Prof. V. C. Soni, Retd.Professor, Saurashtra University, Rajkot, Gujarat	Member
11	Dr. V. Vijay Kumar, Director, Gujarat Institute of Desert Ecology (GUIDE), Bhuj, Gujarat, India.	Member Secretary



THE GUIDE SOCIETY

Sr. No.	Name
1.	Sh. S. G. Mankad, IAS (Retd.), Former Chief Secretary of Gujarat State
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3	Shri. P. K. Taneja, IAS (Retd.), Director General, Gujarat Institute of Disaster Management (GIDM), Gandhinagar, Gujarat
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5	The Member Secretary, Gujarat Ecology Commission (GEC), Gandhinagar, Gujarat
6	The District Development Officer, Kachchh District, Gujarat
7	Prof. Geeta Padate, Maharaja Sayajirao University of Baroda , Vadodara, Gujarat
8	The Member Secretary, Gujarat Pollution Control Board (GPCB), Gandhinagar, Gujarat
9	The Vice Chancellor, Krantiguru Shyamji Krishna Verma Kachchh University, Bhuj, Gujarat
10	Head, Regional Station, Central Arid Zone Research Institute (CAZRI), Kukma, Kachchh. Gujarat
11	Director, Indian Grassland and Fodder Research Institute, Jhansi, Uttar Pradesh
12	The Principal Chief Conservator of Forest (PCCF), GSFD, Gandhinagar, Gujarat
13	Prof. V. C. Soni, Retd. Professor, Saurashtra University, Rajkot, Gujarat
14	Prof. Pragnesh Dave, Professor, Department of Chemistry, S.P. University, Vallabh Vidyanagar, Gujarat
15	Sh. Kantisen C. Shroff, Chairman, Shrujan, Bhujodi, Bhuj-Kachchh Gujarat (till June 2019)
16	Sh. Asim Chakraborty, Director, Welspun Group, Anjar, Kachchh, Gujarat
17	Sh. Dipak Bhimani, Chairman, Navdeep Chemicals Pvt. Ltd, Mumbai, Maharashtra
18	Prof. R. Parthasarathy, Director, Gujarat Institute of Development Research (GIDR), Ahmedabad, Gujarat
19	Dr. V. Vijay Kumar, Director, Gujarat Institute of Desert Ecology (GUIDE), Bhuj, Gujarat, India.



HUMAN RESOURCE

S.No.	Name	Designation
SCIENTIFIC STAFF		
1.	Dr. V. Vijay Kumar	Director
2.	Dr. G. A. Thivakaran	Chief Principal Scientist (till 10 th April 2019)
3.	Dr. K. Karthikeyan	Senior Scientist
4.	Dr. Rachna Chandra	Senior Scientist
5.	Dr. Arun Kumar Roy Mahato	Senior Scientist
6.	Dr. K. R. Saravanan	Senior Scientist
7.	Dr. Nikunj B. Gajera	Scientist
8.	Dr. Jayesh B. Bhatt	Scientist
9.	Dr. G. Thirumaran	Scientist
10.	Dr. G. Jayanthi	Scientist
11.	Dr. L. Prabha Devi	Advisor
12.	Dr. K. Prabhu	Project Scientist
13.	Dr. Durga Prasad Behera	Project Scientist
14.	Dr. V. Selvakumar	Project Scientist
15.	Dr. S. Sivaraj	Project Scientist
16.	Dr. Nakul Bhatt	Research Associate
17.	Ms. Dipmala Gajjar	Women Scientist (WOS-A)
PROJECT STAFF		
18.	Mr. Dayesh M. Parmar	Project Officer (GIS & RS)
19.	Mr. Mukesh H. Koladiya	Project Fellow
20.	Mr. Ajay K. Gohel	Senior Research Fellow
21.	Mr. Bhagirath R. Paradva	Senior Research Fellow
22.	Mr. Rakesh A. Poptani	Senior Research Fellow
23.	Mr. Viral D. Vadodariya	Senior Research Fellow
24.	Mr. Pratik D. Sengani	Senior Research Fellow
25.	Mr. Jayrajsinh R. Mori	Senior Research fellow
26.	Mr. Parasl Pal	Junior Research Fellow
27.	Ms. Asha Sharma	Project Fellow
28.	Mr. Deba Prasad Das	Senior Research Fellow (till 30th June 2019)
29.	Mr. Keyur Modi	Junior Research Fellow (till 30th June 2019)

S.No.	Name	Designation
LABORATORY STAFF		
30.	Mr. Ratansi Chaudhary	Senior Scientific Assistant
31.	Mr. T. Dhananjayan	Scientific Assistant
32.	Ms. Anjali Thomas	Scientific Assistant
33.	Mr. Hirji K. Dangar	Junior Scientific Assistant
34.	Ms. Monika R. Sharma	Junior Scientific Assistant
35.	Mr. Mahesh Dafda	Junior Scientific Assistant (till 3rd June 2019)
36.	Mrs. Ami D. Lakhani	Junior Scientific Assistant
37.	Ms. Dipti L. Parmar	Junior Scientific Assistant
38.	Ms. Dhara H. Mehta	Junior Scientific Assistant (from 11 th November 2019)
39.	Mr. Raj A. Joshi	Field assistant cum Laboratory Assistant
40.	Mr. Jayanti P. Barot	Field Assistant cum Lab Assistant
41.	Mr. Hiren Chavda	Field Assistant cum Lab Assistant
42.	Mr. Arjan Rabari	Field Assistant cum Lab Assistant
43.	Mr. Isharvarkumar Loncha	Field Assistant cum Lab Assistant
OFFICE STAFF		
44.	Mr. Prakash. M. Patel	Executive Engineer
45.	Mr. Manish Vyas	Administrative Officer
46.	Ms. Geeta Goswami	Accounts Officer
47.	Mr. Arvind Lakum	Driver cum Peon
48.	Mr. Altaf. A. Memon	Driver cum Peon
49.	Mr. Hameed. H. Maniyar	Peon cum Chowkidar
50.	Mr. Dansing Bist	Cook cum caretaker
WATERSHED STAFF		
51.	Mr. Amit Ghodasara	Data Entry Operator
SUPPORTIVE STAFF		
52.	Mr Bhura Bhai	Watchman cum Gardener
53.	Mrs. Ushaben	Sweeper



DOCTORAL STUDENTS

Name of the Supervisor	Name of the Student	Title
Dr. V. Vijay Kumar (GUIDE)	Mr. Raghvendra M. Ramanuj Ph.D. (Thesis submitted) K.S.K.V. Kachchh University, Bhuj, Gujarat	Evaluation of Physico - Chemical Characteristics of selected Ground Water sources of Kachchh District, Gujarat with special emphasis on Nitrate and Fluoride contamination.
Dr. K. Karthikeyan (GUIDE)	Mr. T. Dhananjayan Ph.D. (Environmental Science) Bharathiar University, Coimbatore, Tamilnadu	Studies on marine pollution with special reference to heavy metals and petroleum hydrocarbons in the vicinity of industrial cluster, Vadinar, Jamnagar
	Mr. K. P. Nithul Lal Ph.D. (Environmental Science) Bharathiar University, Coimbatore, Tamilnadu	Development of low cost technology for production of water soluble pigments from halotolerant microbial strains
Dr. K. Karthikeyan (Co-GUIDE)	Ms. Monika. R. Sharma Ph.D. (Environmental Science) K.S.K.V. Kachchh University, Bhuj, Gujarat	Application of amendments to promote the growth of selected crops in saline soils of Kachchh, Gujarat: An Environment friendly sustainable approach
	Ms. Anjana Trivedi Ph.D (Biotechnology) Amity University Raipur, Chhattisgarh	Antibiotic resistance pattern of drinking water bacterial isolates from Raipur district of Chhatisgarh: Undrstanding health risks and antibiotic resistance genes.
Dr. B. Anjan Kumar Prusty (Guide) Dr. Rachna Chandra (Co-Guide)	Mr. Soumya Ranjan Mishra Ph.D. (Thesis submitted) K.S.K.V. Kachchh University, Bhuj, Gujarat	Removal of metals from contaminated soil through phytoextraction:impact of amendments. metal concentrations and soil fraction
Dr. Gaurav Agarwal (Guide), Dr. Rachna Chandra (Co-Guide)	Mr. Pratik D. Sengani Ph.D. (Environmental Science) RK University, Rajkot,Gujarat	Study on characterization of ambient air pollution and it's effect on humans in and around Gandhidham, Gujarat
Dr. Arun Kumar Roy Mahato (Co-GUIDE)	Mr. Harish Prajapati Ph.D. (Environmental Science) Rai University, Ahmedabad, Gujarat	Status, Ecology and Conservation of Aquatic Avian fauna of Thol Sanctuary, Mehsana district, Gujarat
Dr. Arun Kumar Roy Mahato (Co-GUIDE)	Mrs. Dipmala Gajjar Ph.D. (Botany) K.S.K.V. Kachchh University, Bhuj, Gujarat	Phyto-sociology, Diversity and Distribution of Climbers in dryland ecosystems of Kachchh, Gujarat



Student Details	Title
Under the Guidance of Dr. K. Karthikeyan	
Jalpa. J. Bhimbha M. Sc. (Chemistry) K.S.K.V. Kachchh University, Bhuj, Gujarat	Antimicrobial susceptibility pattern and MAR index of bacterial isolates from different drinking water sources of Bhuj-Kachchh, Gujarat: Special reference to heavy metal resistance and plasmid DNA extraction
Vaibhavi. M. Lathiya M. Sc.(Chemistry) K.S.K.V. Kachchh University, Bhuj, Gujarat	Optimization experiment for DO, BOD and COD in different water types: Effect of seeding material and aeration time
Mr. Varun Shukla M. Sc. (Environmental Science) K.S.K.V. Kachchh University, Bhuj, Gujarat	Assessment of ambient air quality around municipal solid waste dumping site Nagor road, Bhuj
Ms. Aashka Bhatt M. Sc. (Microbiology) The I. I. S University, Jaipur, Rajasthan	Antimicrobial susceptibility pattern and MAR index of bacterial isolates from different drinking water sources of Bhuj-Kachchh, Gujarat: Special reference to heavy metal resistance and plasmid DNA extraction
Mr. Axay Solanki M. Sc. (Chemistry) K.S.K.V. Kachchh University, Bhuj, Gujarat	Optimization experiment for DO, BOD and COD in different water types: Effect of seeding material and aeration time
Mr. Nikhil Dhamani M. Sc. (M.Tech. Environmental Engineering) K.S.K.V. Kachchh University, Bhuj, Gujarat	Assessment of ambient air quality around municipal solid waste dumping site Nagor road, Bhuj
Mr. Rajesh Kahor M. Sc. (Chemistry) K.S.K.V. Kachchh University, Bhuj, Gujarat	Comparative Assessment Of Hypersaline Terrestrial sediment and mangrove sediment From Kachchh, Gujarat With To Special reference to physico–Chemical Constituents
Mr. Haresh Kachad M. Sc.(Chemistry) K.S.K.V. Kachchh University, Bhuj, Gujarat	Studies on select physical and chemical constituents of hypersaline sediment samples from Rann of Kachchh, Gujarat
Ms. Urmila Patel M. Sc.(Chemistry) K.S.K.V. Kachchh University, Bhuj, Gujarat	Studies On Hypersaline Sediments From Athalassohaline Environment Of Rann Of Kachchh, Western India
Ms. Dipti Parmar M. Sc. (Environmental Science) K.S.K.V. Kachchh University, Bhuj, Gujarat	Environmental monitoring and Management plan for a Steel Plant with special reference to Ambient Air, Stack and Noise environment



Student Details	Title
Under the Guidance of Dr. Rachna Chandra	
Ms. Hiral M. Tala M. Sc. (Chemistry) K.S.K.V. Kachhh University, Bhuj, Gujarat	Heavy metals in the PM10 samples collected from industrial region
Ms. Drashti K. Kotadiya M. Sc. (Chemistry) K.S.K.V. Kachchh University, Bhuj, Gujarat	Heavy metals in the PM2.5 samples collected from industrial region
Under the Guidance of Dr. Nikunj B. Gajera	
Mr. Arnish Prajapati M.Sc. (Environmental Science) Hemchandracharya North Gujarat University	Status, Distribution and Diversity of avifauna in Dholera SIR region, Gujarat
Under the Guidance of Dr. V. Selvakumar	
Mr. Kumarchawan Shakya MSW (Social Work) K.S.K.V. Kachchh University, Bhuj, Gujarat	Tourism and Development: Host perceptions of Tourism impact with special reference to Rann Utsav, Kachchh, Western India.
Under the Guidance of Dr. K. Karthikeyan	
Mr. Pankaj Vaghamshi Mr. Swapnil Vasaiya B.Sc. (Marine Science) Government Science College, Mandvi, Gujarat	Studies on biological characteristics of marine water and sediment samples from Vadinar coast, Gujarat
Under the Guidance of Dr. Durga Prasad Behera	
Mr. Prasad S Gadhavi Mr. Mahadev N Gadhavi Mr. Rahul J Maheshwari B.Sc. (Marine Science) Government Science College, Mandvi, Gujarat	Marine litter generation by different source of activity along Mandvi Coastal environment



TRAINING / INTERNSHIP

Name of the Student	Degree	University/College	Title
Under the Guidance of Dr. K. Karthikeyan			
Ms. Kanishka. P Ms. Soundarya. S., Ms. Gayathri, K	M.Sc Environmental Science	Bharathiar University, Coimbatore	Instrumentation and Analytical skills related to Water and soil analysis
Ms. Vrunda Panchani Ms. Sarvangi Dalsaniya	M.Sc. Microbiology	School of Life Sciences, Atmiya University,Rajkot	
Mr. Mohamed Fakrodeen Mr. B. Manoj	MBA Environmental Management	Bharathidasan University,Trichy	
Ms. Dhrupti. M. Sorthiya Ms. Zarna. A. Jani	Environmental Engineer	Earth Envirotech Laboratory, Gandhidham	Instrumentation and analytical skills related to Ambient Air Monitoring and Wastewater analysis
Mr. Ashish. K. Humbal	Chemist		
Under the Guidance of Dr. Arun Kumar Roy Mahato			
Ms. Pooja Gupta	M.Sc. Biodiversity Conservation	Guru Gobind Singh Indraprasth University, Delhi	Study on habitat preference and ecology of spiny-tailed lizard, Saara hardwickii (Grey, 1827) in Arid Kachchh
Ms. Priyanka Garg			Study on Sacred Groves and its role in Biodiversity Conservation in Dryland of Kachchh, Gujarat
Under the Guidance of Dr. G. Jayanthi			
Ms. Seema Baldaniya Ms. Payal Vaghamshi Ms. Ruchi Hingrajiya Ms. Urvashi Vekariya	M.Sc. Biotechnology	School of Life Sciences, Atmiya University,Rajkot	Instrumentation and Analytical skills for extraction of biomolecules
Ms. Komal Pahal Ms. Preeti Reddy Ms. Geeta Kadachha Ms. Dhwira Thacker Ms. Binal Ramani	B.Sc., Biotechnology	School of Life Sciences, Atmiya University	Phytochemical screening of plants in GUIDE campus, Bhuj



ક્રીક વિસ્તારમાં થેરિયાંની નુકસાની જોઈ ટીમ ચોંકી

ભવાઈ, તા. ૧૦ : ગ્રીન ફિલ્ડના પાંચ આંશમાં પહેલો ઉમેદ સ્ટેડિયમ ટીમ ખરાબ આવરી વાગે કહી વિસ્તારમાં ફાટારાં આવી હતી. આજના મેચમાં ટીમમાં હુકુ ટીમ વિસ્તારમાં ખેલાડી કમી માટે ટીમમાં પ્રવેશ કરવામાં આવ્યું. આ મેચમાં ટીમમાં ખેલાડી કમી માટે ટીમમાં પ્રવેશ કરવામાં આવ્યું. આ મેચમાં ટીમમાં ખેલાડી કમી માટે ટીમમાં પ્રવેશ કરવામાં આવ્યું.

ભવાઈ, તા. ૧૦ : ગ્રીન ફિલ્ડના પાંચ આંશમાં પહેલો ઉમેદ સ્ટેડિયમ ટીમ ખરાબ આવરી વાગે કહી વિસ્તારમાં ફાટારાં આવી હતી. આજના મેચમાં ટીમમાં હુકુ ટીમ વિસ્તારમાં ખેલાડી કમી માટે ટીમમાં પ્રવેશ કરવામાં આવ્યું.

ખેલના અંતે ટીમમાં ખેલાડી કમી માટે ટીમમાં પ્રવેશ કરવામાં આવ્યું. આ મેચમાં ટીમમાં ખેલાડી કમી માટે ટીમમાં પ્રવેશ કરવામાં આવ્યું. આ મેચમાં ટીમમાં ખેલાડી કમી માટે ટીમમાં પ્રવેશ કરવામાં આવ્યું.

કચ્છમાં કિસાનોએ ખેતપદ્ધતિ બદલવી પડશે

ખુજ, તા. ૧૧ : કિસાનોએ ચોંકાવેલા પાણીના સ્તરને જોઈને તેમણે ખેતપદ્ધતિ બદલવાની જરૂર જણાવી છે. તેમણે કહ્યું છે કે કિસાનોએ ખેતપદ્ધતિ બદલવી પડશે. તેમણે કહ્યું છે કે કિસાનોએ ખેતપદ્ધતિ બદલવી પડશે.

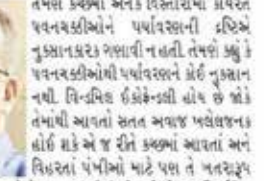


પાલ ભાગલે કાલે પાણીની સમસ્યાનો અભ્યાસ કર્યો હતો. તેમણે કહ્યું છે કે કિસાનોએ ખેતપદ્ધતિ બદલવી પડશે.

દરિયાકાંઠો કલાયમેટ ચેન્જથી પ્રભાવિત : માછલી ઉત્પાદનને અસર : ગાઈડ

પર્યાવરણ ક્ષતિમાં જલ, વાયુ અને જમીન સમાવિષ્ટ છે અને અભારે જળવાયુ પરિવર્તન એટલે કે ક્લાયમેટ ચેન્જના કારણે દરિયાકાંઠો ક્લાયમેટ ચેન્જથી પ્રભાવિત થઈ રહ્યો છે. તેના કારણે માછલી ઉત્પાદનને અસર પહોંચી રહી છે. ગાઈડે કહ્યું છે કે ક્લાયમેટ ચેન્જના કારણે દરિયાકાંઠો ક્લાયમેટ ચેન્જથી પ્રભાવિત થઈ રહ્યો છે.

પર્યાવરણ ક્ષતિમાં જલ, વાયુ અને જમીન સમાવિષ્ટ છે અને અભારે જળવાયુ પરિવર્તન એટલે કે ક્લાયમેટ ચેન્જના કારણે દરિયાકાંઠો ક્લાયમેટ ચેન્જથી પ્રભાવિત થઈ રહ્યો છે.



ગાઈડે કહ્યું છે કે ક્લાયમેટ ચેન્જના કારણે દરિયાકાંઠો ક્લાયમેટ ચેન્જથી પ્રભાવિત થઈ રહ્યો છે.

કચ્છના પર્યાવરણીય પડકારો સામેના 'ગાઈડ'

આજના મેચમાં ટીમમાં હુકુ ટીમ વિસ્તારમાં ખેલાડી કમી માટે ટીમમાં પ્રવેશ કરવામાં આવ્યું. આ મેચમાં ટીમમાં ખેલાડી કમી માટે ટીમમાં પ્રવેશ કરવામાં આવ્યું.

આજના મેચમાં ટીમમાં હુકુ ટીમ વિસ્તારમાં ખેલાડી કમી માટે ટીમમાં પ્રવેશ કરવામાં આવ્યું. આ મેચમાં ટીમમાં ખેલાડી કમી માટે ટીમમાં પ્રવેશ કરવામાં આવ્યું.

આજના મેચમાં ટીમમાં હુકુ ટીમ વિસ્તારમાં ખેલાડી કમી માટે ટીમમાં પ્રવેશ કરવામાં આવ્યું. આ મેચમાં ટીમમાં ખેલાડી કમી માટે ટીમમાં પ્રવેશ કરવામાં આવ્યું.



આજના મેચમાં ટીમમાં હુકુ ટીમ વિસ્તારમાં ખેલાડી કમી માટે ટીમમાં પ્રવેશ કરવામાં આવ્યું.

પ્લાસ્ટીકનો પર્યાય જ પર્યાવરણને બચાવી શકશે

પ્લાસ્ટીકનો પર્યાય જ પર્યાવરણને બચાવી શકશે. તેમણે કહ્યું છે કે પ્લાસ્ટીકનો પર્યાય જ પર્યાવરણને બચાવી શકશે.

પ્લાસ્ટીકનો પર્યાય જ પર્યાવરણને બચાવી શકશે. તેમણે કહ્યું છે કે પ્લાસ્ટીકનો પર્યાય જ પર્યાવરણને બચાવી શકશે.



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'પ્લાસ્ટિક ફી ઇન્ડિયા'ની મુખ્યમંત્રી વચ્ચે ગુજરાતના પૈજ્ઞાનિકોએ શોધ્યું 'બાયો પ્લાસ્ટિક': થેરિયામાંથી મળ્યો 'ડીઝાઇનબલ' પ્લાસ્ટિકનો વિકલ્પ

પ્લાસ્ટિકનો પર્યાય જ પર્યાવરણને બચાવી શકશે. તેમણે કહ્યું છે કે પ્લાસ્ટિકનો પર્યાય જ પર્યાવરણને બચાવી શકશે.

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ઓઝોની સ્તર ઓછું

ઓઝોની સ્તર ઓછું. તેમણે કહ્યું છે કે ઓઝોની સ્તર ઓછું.

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'Climate change impact to get more severe in Gujarat'

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થેરિયામાંથી મળ્યો પ્લાસ્ટિકનો વિકલ્પ

થેરિયામાંથી મળ્યો પ્લાસ્ટિકનો વિકલ્પ. તેમણે કહ્યું છે કે થેરિયામાંથી મળ્યો પ્લાસ્ટિકનો વિકલ્પ.

થેરિયામાંથી મળ્યો પ્લાસ્ટિકનો વિકલ્પ. તેમણે કહ્યું છે કે થેરિયામાંથી મળ્યો પ્લાસ્ટિકનો વિકલ્પ.





Gujarat Institute of Desert Ecology

P. O. Box No. 83, Opp. Changleshwar Temple, Mundra Road, Bhuj - 370001, Kachchh, Gujarat, India.
Telephone: 02832-235025 • E-mail: desert_ecology@yahoo.com • www.gujaratdesertecology.com

Editors : Dr. V. Selvakumar, Dr. Jayesh Bhatt & Dr. V. Vijay Kumar

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